SALEM LOCAL ENERGY ASSURANCE PLAN

Final Report

Prepared for:

City of Salem

Prepared by:

Community Planning Workshop

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CHAPTER 1: INTRODUCTION

1.1 PROJECT OVERVIEW

In 2009 the City of Salem submitted an application and secured funding to develop a Local Energy Assurance Plan (LEAP). The funding was part of the American Recovery and Reinvestment Act channeled through the U. S. Department of Energy's (DOE) National Energy Technology Laboratory (NETL) under their recently created Local Energy Assurance Planning (LEAP) Initiative. This project created an energy assurance plan for the local community through a cooperative process involving the City staff, public and private utilities, the Oregon Department of Energy, the Oregon Public Utility Commission, private industry, and other key organizations. The City of Salem Emergency Management Division was the lead agency for this City project.

The City of Salem relies on a range of energy sources to support and protect local residents, businesses, and government facilities. Accordingly, secure supplies of energy (e.g., electricity, gasoline, diesel fuel, natural gas, propane) to critical facilities/infrastructure, especially during emergency events, is of crucial importance to all segments of the community. An energy assurance plan is essentially a plan for how the City will recover and restore energy services to critical functions and facilities/infrastructure within a predetermined time after a partial or complete energy supply interruption. The Plan identifies critical facilities and critical infrastructure needing back-up power generation capacity to ensure continued operation during emergency events. The Plan establishes short-term communication protocols, actions and priorities by which critical facilities/infrastructure will be re-energized after a disruption, as well as long-term strategies for making critical facilities and critical infrastructure less vulnerable to disruptions of mainline energy sources.

The City of Salem contracted with the University of Oregon's Community Service Center[1] (CSC) to assist the City in developing its Local Energy Assurance Plan (LEAP). The CSC facilitated the local energy assurance planning process utilizing the Public Technology Institute's (PTI) Guidelines for the writing of such plans on a nation-wide basis. CSC also provided technical assistance for the development and writing of this Plan.

1.2 PUBLIC TECHNOLOGY INSTITUTE (PTI) GUIDELINES

The Local Energy Assurance Plan (LEAP) Initiative focuses on developing new, or refining existing, plans to integrate new energy portfolios (e.g., renewables, biofuels) and new applications, such as Smart Grid technology, into energy assurance and emergency preparedness plans. Better planning efforts help contribute to the resilience of the energy sector, including the electrical grid, by focusing on the entire energy supply

[1] The CSC team included staff from the Oregon Partnership for Disaster Resilience (OPDR), and the UO Community Planning Workshop (CPW) program, and the UO InfoGraphics Lab.

system, including refining, storage, and distribution of non-renewable and renewable fuels. This LEAP project utilized the DOE's Public Technology Institute (PTI) Guidelines.[2]

As noted on page 2 of the DOE publication Local-Level Energy Assurance Framework: 10 Steps to Build a Plan[3], effective energy assurance planning aids local jurisdictions in answering two fundamental questions:

1. *After an energy disruption, what steps can be taken at the local level to mitigate negative consequences, maintain critical services, and facilitate rapid recovery?*

2. *What practical and cost-effective longer-term strategies and/or investments (e.g., diversification of energy supplies, development of distributed/renewable energy sources, net metering/smart grid deployment) can be implemented at the local level to increase the resiliency of local energy infrastructure?*

Page 4 of this same DOE publication presents an outline of the ten step energy assurance planning framework. Those ten steps are summarized as follows:

1. *Build an Energy Assurance Response and Planning Team:*
    a. Designate an Energy Assurance Coordinator
    b. Establish a Local Energy Assurance Working Group or Task Force
    c. Build Personnel Redundancy Into the Planning Framework
2. *Know Your Emergency Legal Authorities:* Understand the Legal Frameworks under Which Your Planning/Response Efforts Will Operate
3. *Understand Your Roles and Responsibilities:* Know Which Key Organizations are Responsible for Responding to an Energy Disruption
4. *Know Your Energy Profile:* Understand the Relationship of Your Jurisdiction's Electricity, Petroleum, and Natural Gas Markets to State and Regional Markets
5. *Identify Key Energy Suppliers:* Understand the Suppliers, Contracts, and Infrastructure Serving Your Jurisdiction's Electricity, Petroleum, and Natural Gas Needs
6. *Know Your Key Contacts:* Develop/Maintain a List Including Your Jurisdiction's Key Energy Sector, Service Provider, Emergency Management, and Public Official Contacts
7. *Identify Key Assets:*
    a. Identify the Facilities/Infrastructure Providing Critical Local Services
    b. Develop an Understanding of Existing Public and Private Sector Response Plans to Determine Which Key Assets are Most Vulnerable to an Energy Disruption or Emergency

[2] The PTI guidelines can be found online at: http://www.energyassurance.us/index.php/leap/inside/C7

[3] Prepared by the U.S. Department of Energy in July, 2010 as a Supplement to the Public Technology Institute, Local Government Energy Assurance Guidelines (2009) for the purpose of implementing the Recovery Act Local Energy Assurance Planning (LEAP) Initiative (FOA: DE-FOA-0000098).

8. *Develop a Crisis Communications Protocol:* Be Ready to Talk to Your Partners, the Public, and the Media
9. *Develop State/Regional/Federal Partnerships for Energy Assurance:* Coordinate Planning and Response Efforts with Other Public Authorities to Utilize Additional Resources and Expertise Effectively
10. *Update Your Plan on a Consistent Basis:* Reexamine Central Plan Components Regularly in Light of New Data and Lessons Learned

DOE also adds a step that is ongoing: *Organize/Participate in Disruption Planning Exercises and Stay Current on Energy Market Issues and Developments.*

1.3 CITY OF SALEM OBJECTIVES AND COMMUNITY BENEFITS

Consistent with the PTI Guidelines, key City of Salem objectives for this LEAP project included the following:

1. Strengthen and expand local government energy assurance planning and resiliency.
2. Reduce the impacts from energy supply disruptions.
3. Fortify and strengthen the relationships with energy suppliers.
4. Define local facilities requiring sustained energy sources to continue operations.
5. Develop prioritized levels of energy usage for critical facilities during sporadic outages and recovery operations.

Furthermore, Salem's Energy Assurance Plan also addresses the following elements:

1. Critical (physical) Assets;
2. Threat Environment;
3. Policies and Procedures;
4. Physical Security;
5. Operations Security;
6. Consequence Analysis;
7. Risk Characterization;
8. Protection of Sensitive Information; and
9. Alternative Energy Sources.

Accordingly, this Energy Assurance Plan provides a number of benefits for the community, including enhanced knowledge and understanding of:

- the roles and responsibilities of government agencies and energy providers;
- investments needed to make energy systems more resilient;
- identified energy demands and actions necessary to extend resources through the use of alternative energy sources and energy efficiency;
- response actions for energy disruptions;

- relationships needed to provide mutual aid across organizations to respond effectively during energy disruptions.

A key outcome of this LEAP project for Salem is a greater understanding of the interrelationships of the energy industry, emergency response organizations and the community with emergency planning efforts.

1.4 THE LEAP PLANNING PROCESS SUMMARIZED

1.4.1 Salem's LEAP Resource Group

In accordance with the PTI Guidelines, the efforts of this City project were informed by a resource group comprised of public and private sector representatives whose combined expertise reflects an in-depth, practical familiarity with energy assurance issues and challenges at the local and regional level. The members of the LEAP Resource Group had the knowledge and detailed information, as well as expertise, essential for: (1) the successful completion of this project; and, (2) the crafting of an effective plan to help the community respond to and recover from emergency events that disrupt the area's normal supply of energy. The Resource Group met periodically throughout 2011 to coordinate data collection and review the work of the CSC.

1.4.2 CSC Team and City Staff

Day to day management and work on the project was conducted by the CSC Team in close cooperation with City of Salem staff, headed by Salem's Emergency Management Division.

The CSC Team conducted research and drew upon expertise in the field on a nation-wide basis, as well as within the State of Oregon and the local community. The CSC Team:

- Prepared this City of Salem Energy Assurance Plan, incorporating new and emerging energy technologies;
- Reviewed and suggested revision, as needed, of relevant City policies and guidelines;
- Hired an independent consulting team from Blaine, Washington, to prepare and conduct training and a table top exercise (October 5, 2011) to test the plan, particularly Annex Y[4] to the Salem Emergency Management Plan (SEMP);
- Assisted the City in developing partnerships with key organizations involved in energy transmission and delivery;
- Identified short- and long-term strategies and actions to minimize the impact of energy disruptions; and,
- Prepared geographic information system (GIS) data to support the planning effort.

[4] Annex Y was prepared by the CSC Team as the major component of the LEAP's short term strategies for responding to energy emergencies and disruptions.

1.5 KEY DEFINITIONS AND CONCEPTS

The concepts and definitions that follow are taken from the PTI LEAP Guidelines and other relevant sources. Additional materials on the LEAP process – including the Guidelines – are available at the LEAP website: http://energyassurance.us/ .

1.5.1 Energy Assurance

As noted in the PTI Guidelines (page 7):

> *Energy assurance is about building resilience and redundancy into energy systems, so cities, counties, regions and citizens can survive without help for three days or longer if necessary. . . It involves saving lives and maintaining economic competitiveness. . . Energy assurance is also about guaranteeing citizens that reliable services (power cannot be guaranteed) will be there when they are needed.*

1.5.2 Energy Resilience

Human-built systems, including critical infrastructure and facilities, are not "fail-safe" or immune to damage. For example, energy systems are not and cannot be 100 percent damage proof. Attainable, however, are goals to mitigate damage and build the capacity for resilience. Resilience is the ability to respond effectively to an emergency event and to recover quickly from damage; it is the ability to "bounce back." A resilient system is not necessarily even damage-resistant. Rather, a resilient system is able to continue operating despite damage, and to return quickly to normal operations after damage occurs. Accordingly, resilience is considered to be as important goal of mitigation as is damage prevention.

1.5.3 Enhancing Energy Assurance and Resilience

Energy assurance, in conjunction with resilience, provides the capacity to make energy available when needed for critical functions. Increasing energy assurance and resilience requires actions to reduce vulnerability to emergency events, especially those resulting in energy disruptions. Enhancing energy assurance and resilience requires an array of activities that fall into three main categories: preparation and planning; response; and education and outreach.

- Preparation and planning involve identifying key assets (e.g., critical facilities/infrastructure) and personnel, designing and updating energy emergency response plans, training personnel, and conducting exercises that test the effectiveness of response plans.
- Response activities include monitoring events that may affect energy supplies, assessing the severity of disruptions, providing situational awareness, coordinating restoration efforts, and tracking recoveries.
- Education and outreach activities include communicating and coordinating with key stakeholders, increasing public awareness, and forming partnerships.

1.5.4 Mitigation

Mitigation, along with Preparedness, Response and Recovery, are the key phases of Emergency Management; Planning is fundamental for all the phases. The 2006 Salem Emergency Management Plan (SEMP) defines Mitigation as including

> *". . . activities aimed at eliminating or reducing the likely effects of an emergency. Examples of mitigation measures that the city may take through the regular administrative process are: land use planning that result in zoning ordinances prohibiting development in flood plains; building codes to address seismic survivability; or city ordinances prohibiting certain dangerous activities such as storage or manufacture of hazardous materials or explosives within prescribed circumstances. It also includes activities designed to postpone, dissipate, or lessen the effects of an emergency. Pre-incident planning and public education are important aspects of the mitigation phase."*

Mitigation strategies and actions generally occur before and after an emergency event, and not during the response phase. In the context of this LEAP Plan, mitigation is comprised of short-term and long-term strategies and actions to lower or lessen the impacts of an energy disruption emergency event. By protecting backup power capacity, reducing operational energy consumption of city-owned facilities, and promoting energy independence, Salem can enhance both energy assurance and resilience.

1.5.5 Vulnerability

Vulnerability is the degree to which individuals, the community as a whole, the built environment, systems, other assets and resources, and cultural, economic, and social activity is susceptible to harm, degradation, or destruction. Energy vulnerability is the likelihood or the degree to which the essential energy supply of any given community asset will be disrupted or exhausted during an emergency event. Vulnerability can be reduced by mitigating actions that lessen the impacts of an emergency event, and in the context of this LEAP project, actions to enhance both energy assurance and resilience.

1.5.6 Critical Facilities and Critical Infrastructure

Critical facilities/infrastructure and their energy needs are a central focus of this LEAP Plan. Incorporating the particular needs of an energy assurance plan into the context of traditional definitions of critical facilities and infrastructure from the perspective of emergency management, takes into account both the vital functions of critical facilities and infrastructure as well as the essential nature of their energy needs. Accordingly, this plan includes the following definition of critical facilities and critical infrastructure for the purposes of this City of Salem study and plan:

> *A critical community asset is a facility or infrastructure element that provides functions that are vital for **(1)** the protection of the health, safety and life of the City's population as well as **(2)** the maintenance of the City's built environment, especially other critical assets, and is **(3)** essential for government response and recovery activities during an emergency. Such facilities and infrastructure elements are designated as **CRITICAL**. Accordingly, the assurance of access to adequate supplies of energy for continued functioning is necessary for critical facilities and critical infrastructure elements.*

1.5.7 Mission Critical Operations

The PTI Guidelines[5], indicate that a key element of Energy Assurance Plans is that mission critical operations (facilities, systems, and components) be identified, data collected on how they are powered, and on any available back-up power systems. Furthermore, the PTI Guidelines note that:

> *When identifying mission critical operations the security and protection of drinking water and wastewater protection should also be considered. The health effects associated with a widespread water distribution problem are potentially catastrophic. Water is important in many manufacturing processes, as well as for drinking and ice for preserving food and medicine and for fighting fires. As much as twenty percent of energy costs are from simply moving water to where it is needed; there are significant interdependencies. Critical water customers should be identified and a priority established on which ones will be given first priority for restored service.*

1.5.8 Restoration Priorities

The PTI Guidelines (pages 7-8) include an emphasis on establishing priorities for restoring energy flows after an emergency event:

> *It is important to establish energy (electric and natural gas) infrastructure priorities, independent of, but in concert with the local utility. Identify essential customer services and ensure that these customers are considered priority customers by the utility. It is easy to look over this last point. If the jurisdiction and utility do not discuss priority customers (like the emergency operations center) then when a brown-out occurs for example, they may not direct power to the facilities that are deemed as important and essential!*

The PTI Guidelines present a number of possible ranking systems for the restoration of power. In many cases it may be essential that the first priorities are the critical facilities and infrastructure necessary for the generation and distribution or delivery of energy. One ranking system for restoration of energy flows, based on Florida's response to hurricane damages in 2004, is as follows:

- *Hospitals;*
- *Public service entities including, emergency operations centers, critical government facilities, and Red Cross facilities;*
- *Communications with emergency responders including police and fire, telecommunications and the media;*
- *Water and sewage facilities;*
- *Transportation infrastructure;*
- *Gas supply utilities;*
- *Electric company facilities;*
- *Other essential entities such as schools, nursing homes, and critical care facilities; and*
- *Others as designated in coordination with government and the emergency operation* centers.

[5] PTI Guidelines, op cit., page 7.

1.5.9 Criticalness of Function and Vulnerability of Energy Supplies

There is a distinction between critical function and vulnerability. The critical nature of a facility or infrastructure element is the importance of its functions (and hence the importance of its access to adequate energy supplies) for the protection of human life, health and safety, and the built environment especially life lines. Vulnerability, on the other hand, is the likelihood that the entity's energy supply will be disrupted or exhausted during an emergency event.

1.5.10 Organization of Content

Salem's Local Energy Assurance Plan is organized as follows:

- **Chapter 2**: Using the PTI Guidelines, this Local Energy Assurance Plan begins by defining and identifying key assets of the City of Salem including highest priority facilities and infrastructure required for maintaining critical functions of City operations.

- **Chapter 3**: A thorough review of existing policy and procedure is included in Chapter 3, from which this document derives its foundation, including legal authority and procedural norms.

- **Chapter 4**: Profiles of energy consumption, supply, distribution, and vulnerabilities at the State and City levels are included in Chapter 4, an analysis of the energy consumption by City of Salem critical facilities.

- **Chapter 5**: Chapter 5 assesses the existing threat environment, develops a risk assessment tool and methodology, and provides guidance on physical, operational, and cyber security threats.

- **Chapter 6:** Chapter 6 concludes this LEAP document with recommendations to improve select City of Salem policies and procedures, in the interest of furthering energy resilience goals of the City, in both the short- and long-term.

Table 1.1, below, provides an outline from the PTI Guidelines of the *10 Steps to Build a Plan* with references to how this LEAP document satisfies these PTI guidelines.

TABLE 1.1 LEAP DOCUMENT AND DELIVERABLES CROSSWALK WITH PTI GUIDELINES

As noted on page 2 of the DOE publication Local-Level Energy Assurance Framework: 10 Steps to Build a Plan[6], effective energy assurance planning aids local jurisdictions in answering two fundamental questions:

PTI	SECTION OF LEAP DOCUMENT AND/OR PACKAGE OF OTHER DELIVERABLES
3. *After an energy disruption, what steps can be taken at the local level to mitigate negative consequences, maintain critical services, and facilitate rapid recovery?*	This reference in the PTI Guidelines refers to short term actions that are two of the four phases of Emergency Management: Response and Recovery. These items are addressed in LEAP Chapter 6 (Policy and Procedure Recommendations) in Sections 6.1, 6.2, 6.6, 6.7, and in ANNEX Y to the Salem Emergency Management Plan and its Appendices. This includes the LEAP GIS database and schema.
4. *What practical and cost-effective longer-term strategies and/or investments (e.g., diversification of energy supplies, development of distributed/renewable energy sources, net metering/smart grid deployment) can be implemented at the local level to increase the resiliency of local energy infrastructure?*	This reference in the PTI Guidelines refers to longer term actions that are one of the four phases of Emergency Management: Mitigation. These items are addressed in LEAP Chapter 6 (Policy and Procedure Recommendations) in Sections 6.1, 6.2, 6.3, 6.5, and 6.7.

Page 4 of this same DOE publication presents an outline of the ten step energy assurance planning framework. Those ten steps are summarized as follows:

PTI	SECTION OF LEAP DOCUMENT AND/OR PACKAGE OF OTHER DELIVERABLES
1. *Build an Energy Assurance Response and Planning Team:*	This initial ground work was laid for the LEAP project in the fall of 2010 and January 2011 with the creation of the LEAP Resource Group (RG). Annex Y provides the framework to transform the RG into an Energy Assurance Advisory Group (EAAG) that can be activated as part of Salem's ICS when needed.
a. Designate an Energy Assurance Coordinator	For the LEAP project, Roger Stevenson of Salem Emergency Management provided this leadership function. As per the provisions of ANNEX Y, the City now needs to appoint an individual and/or work group that will function as the City's Energy Assurance Liaison Officer.
b. Establish a Local Energy Assurance Working Group or Task Force	See 1 above.
c. Build Personnel Redundancy Into the Planning Framework	This is taken into account in the protocols established in ANNEX Y for the different groups selecting their participants in the EAAG.
2. *Know Your Emergency Legal Authorities:* Understand the Legal Frameworks under Which Your Planning/Response Efforts Will Operate	This Guideline is addressed in LEAP Chapter 3 (Review of Existing Policies and Procedures), especially Section 3.1 (Legal Authority and Statutes).

[6] Prepared by the U.S. Department of Energy in July, 2010 as a Supplement to the Public Technology Institute, Local Government Energy Assurance Guidelines (2009) for the purpose of implementing the Recovery Act Local Energy Assurance Planning (LEAP) Initiative (FOA: DE-FOA-0000098).

3. *Understand Your Roles and Responsibilities:* Know Which Key Organizations are Responsible for Responding to an Energy Disruption	Salem began meeting this Guideline in the fall of 2010 and January 2011 with the creation of the LEAP Resource Group (RG). This understanding of roles and responsibilities was further deepened at the Table Top Exercise held on October 5, 2011, to test Annex Y and other related energy assurance issues. This process of understanding will become even more effective through the full implementation Annex Y which provides the framework to transform the RG into an Energy Assurance Advisory Group (EAAG) that can be activated as part of Salem's ICS when needed.
4. *Know Your Energy Profile:* Understand the Relationship of Your Jurisdiction's Electricity, Petroleum, and Natural Gas Markets to State and Regional Markets	This Guideline is addressed in LEAP Chapter 4 (Salem Community Fuel and Energy Profile).
5. *Identify Key Energy Suppliers:* Understand the Suppliers, Contracts, and Infrastructure Serving Your Jurisdiction's Electricity, Petroleum, and Natural Gas Needs	This Guideline is addressed in LEAP Chapter 4 (Salem Community Fuel and Energy Profile).
6. *Know Your Key Contacts:* Develop/Maintain a List Including Your Jurisdiction's Key Energy Sector, Service Provider, Emergency Management, and Public Official Contacts	This Guideline is addressed in the formation of the LEAP Resource Group (RG) and in its transformation into the Energy Assurance Advisory Group (EAAG) established by ANNEX Y. The Roster of the EAAG with its many layers of back-channel contact information will be held as a confidential document by Salem Emergency Management.
7. Identify Key Assets: a. Identify the Facilities/Infrastructure Providing Critical Local Services	This Guideline is addressed in LEAP Chapter 2 (Critical Facility and Infrastructure Inventory), as well as technical appendices to the LEAP document and the LEAP GIS data base and schema.
b. Develop an Understanding of Existing Public and Private Sector Response Plans to Determine Which Key Assets are Most Vulnerable to an Energy Disruption or Emergency	This Guideline is addressed in LEAP Chapter 3 (Review of Existing Policies and Procedures), as well as through ongoing discussions of the Resource Group over the past ten months and the Table Top Exercise held on October 5, 2011. LEAP Chapter 5 (Risk Assessment) addresses threats and vulnerabilities of critical assets, as does both Technical Appendix II (Site Assessment Data) and the LEAP GIS data base and schema.
8. *Develop a Crisis Communications Protocol:* Be Ready to Talk to Your Partners, the Public, and the Media	This Guideline is addressed in the formation of the LEAP Resource Group (RG) and in its transformation into the Energy Assurance Advisory Group (EAAG) established by ANNEX Y.
9. *Develop State/Regional/Federal Partnerships for Energy Assurance:* Coordinate Planning and Response Efforts with Other Public Authorities to Utilize Additional Resources and Expertise Effectively	This Guideline is addressed through ongoing discussions of the Resource Group over the past ten months and the Table Top Exercise held on October 5, 2011, in which participants emphasized the need for regional planning and exercises. The City of Portland and state agencies (e.g., PUC, DOE) participated in the Resource Group from the outset.
10. *Update Your Plan on a Consistent Basis:* Reexamine Central Plan Components Regularly in Light of New Data and Lessons Learned	The City of Salem periodically reviews and updates its emergency management documents. Annex Y and the LEAP plan should become part of that ongoing process, as is Salem's Natural Hazards Mitigation Plan.
DOE also adds a step that is ongoing: *Organize/Participate in Disruption Planning Exercises and Stay Current on Energy Market Issues and Developments.*	The participants at the October 5, 2011, Table Top Exercise recognized this need for ongoing planning and exercises. LEAP Chapter 6 addresses the need to *Stay Current on Energy Market Issues and Developments* and is a key factor in long term mitigation to become more energy resilient.

CHAPTER 2: CRITICAL FACILITY AND INFRASTRUCTURE INVENTORY

2.1 EMERGENCY MANAGEMENT FEDERAL AND STATE DEFINITIONS

The federal government (through the USA Patriot Act and the National Infrastructure Protection Plan) defines critical infrastructure as: "Systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters." [7]

Oregon's 2010 State Emergency Operations Plan defines Critical facilities as "those facilities essential to government response and recovery activities."[8]

In 2007 the **Portland metro region** defined critical infrastructure as:

> *"Publicly and privately controlled systems and assets, including the built and natural environments and human resources, essential to the sustained functioning of the Portland/Vancouver metropolitan area . . . . Such systems and assets specifically include those necessary to ensure continuity of security, safety, health, and sanitation services, support the area's economy, and/or maintain public confidence. Incapacitation or destruction of any of these systems or assets would have a debilitating impact on the area either directly, through interdependencies, and/or through cascading effects.* [9]

2.2 DEFINITION FOR SALEM'S LEAP

Incorporating the particular needs of an energy assurance plan into the context of traditional emergency management definitions of critical facilities and infrastructure takes into account both the vital functions of critical facilities and infrastructure as well as the essential nature of their energy needs. This plan includes the following definition of critical facilities and critical infrastructure for the City of Salem:

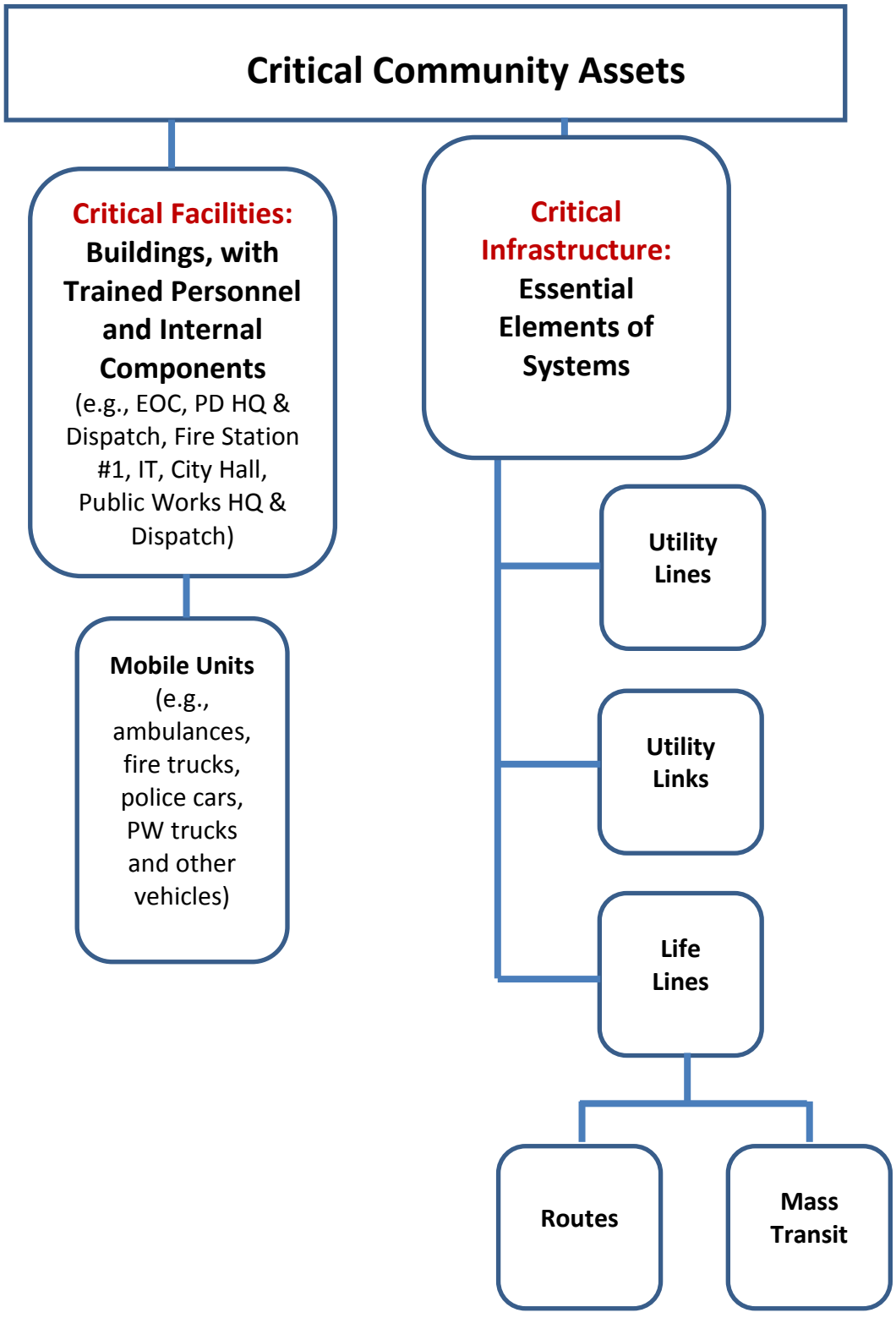
> *A critical community asset is a facility or infrastructure element that provides functions that are vital for **(1)** the protection of the health, safety and life of the City's population as well as **(2)** the maintenance of the City's built environment, especially other critical assets, and is **(3)** essential for government response and recovery activities during an emergency. Such facilities and infrastructure elements are designated as **CRITICAL**. Accordingly, the assurance of access to adequate supplies of energy for continued functioning is necessary for critical facilities and critical infrastructure elements.*

[7] Portland / Vancouver Urban Area Critical Infrastructure Protection Plan, 2007, Section 2-1.
[8] State of Oregon Emergency Operations Plan, September 2010, page 2-4.
[9] Portland / Vancouver Urban Area Critical Infrastructure Protection Plan, 2007, Section 2-1.

2.3 SUBCOMPONENTS OF CRITICAL ASSETS

As shown in **FIGURE 2-1**, the community's Critical Assets can be subdivided into two categories: Critical Facilities and Critical Infrastructure.

Figure 2-1: Components of Critical Facilities and Critical Infrastructure



2.3.1 Critical Facilities

Critical Facilities include buildings, their internal components and trained personnel, and may also include certain mobile units, such as those of first responders. For example, many vehicles of the police department, fire department (including ambulances), and public works department are key and essential components of the functions provided by these critical facilities. Not all Critical Facilities are of equal importance, and are therefore subject to prioritization for purpose of re-energizing during energy disruptions.

2.3.2 Critical Infrastructure

Critical Infrastructure includes system elements that are key components in providing basic services to large numbers of people. Critical infrastructure is essential in providing services vital to the functioning of a modern industrial society; they are especially important to emergency management response and recovery during and after an emergency event. The systems that have Critical Infrastructure elements include potable water, wastewater, communications, electric power, liquid fuel, natural gas, and transportation (roads, streets, highways, ports, rail and transit, airports). Not all utility lines, routes, and so on, are essential and thus may not be classified as Critical in any given community. Critical Infrastructure elements are subject to prioritization as are Critical Facilities, for the same reasons – not all are of equal importance.

2.3.3 Functional Classification of Critical Infrastructure

Designated critical infrastructure can be functionally divided into four sub-categories:

a. **Utility Lines:** Within a community, Utility Lines are critical infrastructure elements such as water lines for fighting fires and providing potable water, sanitary sewer lines, natural gas pipes, electric power lines, and communication cables that connect portions of a utility or transportation system.
b. **Utility Links:** Within a community, Utility Links are critical infrastructure locations with essential functions, such as pumping stations and plants, substations, or switching offices.
c. **Life Lines:**
    1. **Routes:** Within a community, Life Line Routes are the key roads and streets essential for conducting life and safety tasks during emergencies, including serving the needs of critical facilities and other critical infrastructure. Highways may also be Life Line Routes within a community, but may be even more important as Life Line Routes between communities. Bridges may be highly important components of Life Line Routes.
    2. **Mass Transit:** Within a community, Mass Transit Life Lines include highways, ports, rail and transit infrastructure, and airports. While these elements may provide essential functions within a community, their most important Life Line roles may be between communities.

2.4 PRIORITIES OF IMPORTANCE FOR RE-ENERGIZING CRITICAL FACILITIES AND CRITICAL INFRASTRUCTURE AFTER DISRUPTIONS OF NORMAL ENERGY FLOWS

2.4.1 The Need to Rank

As noted above, not all critical facilities and critical infrastructure are of equal importance. During emergencies resulting in the disruption of normal energy flows (e.g., electricity, diesel fuel, gasoline, natural gas, propane), those response teams charged with restoring energy to the community will likely face limited time and resources. Energy response teams will need to prioritize allocation of their efforts and resources to ensure an effective response and recovery effort by the City of Salem and other entities. Dividing the list of critical facilities and critical infrastructure by their importance provides a simple functional framework for response teams to use in their efforts to restore energy services to the community during emergencies resulting in the disruption of normal energy flows.

2.4.2 Ranking Characteristics

The following characteristics can be used to evaluate the degree of importance of critical facilities and critical infrastructure. A comparison of the relative importance of facilities and infrastructure can then be used to determine the order of re-energizing after disruptions of normal energy flows:

a. The importance or priority of a critical facility or critical infrastructure depends on the type of impacts that would result from the loss of its function(s). Negative impacts on human life, safety and health are the highest priority. Of secondary importance is the built environment especially other critical assets directly affecting life, health and safety. These priorities are then followed by impacts on other property and on predetermined key aspects of the local natural environment. The greater the potential impacts, the higher the priority is for re-energizing the given critical facility or critical infrastructure.
b. The importance or priority for re-energizing a given critical facility can also be determined from the speed at which negative impacts begin to occur after a facility loses its energy source(s). The more rapidly impacts begin to occur, the greater the priority of the critical facility or critical infrastructure and restoration of its energy access.

2.4.3 PTI Guidelines and Ranking Systems

The PTI Guidelines present a number of possible ranking systems for the restoration of power. In many cases it may be essential that the first priorities are the critical facilities and infrastructure necessary for the generation and distribution or delivery of energy. One ranking system for restoration of energy flows, based on Florida's response to hurricane damages in 2004, is as follows:

1. Hospitals;
2. Public service entities including, emergency operations centers, critical government facilities, and Red Cross facilities;
3. Communications with emergency responders including police and fire, telecommunications and the media;
4. Water and sewage facilities;
5. Transportation infrastructure;
6. Gas supply utilities;
7. Electric company facilities;
8. Schools, nursing homes, and critical care facilities; and
9. Government and the emergency operation center designated Critical facilities (not in the above lists)

2.4.4 Salem LEAP Critical Facilities and Critical Infrastructure Priority Ranking System

The Salem LEAP uses the following priority ranking scheme; it is based in part on the system used by Horry County, South Carolina, and makes use of the concept of Maximum Allowable Down Time ("MAD Time"). The top three lists of priorities appear below in order of descending importance. (See "MAD Time" in section 2.8.3.a.i below.)

a. **Priority One Critical Facilities and Critical Infrastructure:** The loss of energy supply to these facilities and assets, even for a few hours, could cause severe negative impacts on human life, health and safety, and the built environment, especially critical community assets. They are vital to the emergency response and recovery efforts, and require a constant energy supply to maintain functions. Emergency response plans shall include actions to assure that these Priority One Facilities and Infrastructure regain an adequate and stable source of energy as soon as possible after a disruption of energy flow.

b. **Priority Two Critical Facilities and Critical Infrastructure:** The loss of energy supply to these facilities and assets for more than 24 hours could cause severe negative impacts on human life, health and safety, and the built environment, especially critical community assets. Emergency response plans shall include actions to assure an adequate and stable energy source for these Priority Two Facilities and Infrastructure as soon as all (or as many as possible given the nature of the emergency event) of the Priority One Facilities and Infrastructure have been secured.

c. **Priority Three Critical Facilities and Critical Infrastructure:** The loss of energy supply to these facilities and assets for more than 72 hours could cause significant negative impacts on human life, health and safety, and the built environment, especially critical community assets. They are important to the disaster recovery effort and require an energy supply to maintain functions (although this supply may not need to be at normal levels nor uninterrupted). Emergency response plans shall include actions to secure appropriate energy for these facilities and infrastructure as soon as possible given the nature of the emergency event, and the ability of response and recovery teams to meet the energy needs of as many of the higher priority Critical Facilities and Infrastructure as possible.

2.5 Designated Ranking for Specific Critical Facilities and Infrastructure

Based on the criteria in Section 2.3.3 and the priority ranking noted in Section 2.3.4 above, this plan uses the following designated ranking for specific critical facilities and infrastructure listed in Salem's Inventory vis-à-vis restoration of adequate and stable sources of energy after a disruption of energy flow. Most, but not all, of the Critical facilities and infrastructure listed here are City facilities or infrastructure.

2.5.1 Priority 1

a. Salem Hospital
b. Emergency Response Coordination/Communication: Primary EOC in Willamette Valley Communication Center [911 Services, Emergency Dispatch Services], and Secondary EOC in Salem Fire Department Training Center, Anderson Readiness Center, etc.
c. City of Salem IT Department: computer services support for emergency operations (290 Church St SE)
d. City of Salem Emergency Response (First Responders):
    i. Police -- Salem Civic Center/Police Station and Dispatch (or "DOC," Department Operations Center[10]), and mobile units
    ii. Fire/Ambulance -- Fire Stations and Dispatch(or "DOC"), and mobile units
    iii. Public Works -- Dispatch or "DOC" (1410 20th St SE); Public Works Shops (1410 20th St SE), and mobile units
e. City Fleet Services: vehicles, fuel & service for emergency vehicles (1455 22nd St SE)
f. City Designated Salem Drinking Water and Sewage Facilities and Infrastructure
g. City Governance: City Hall/Salem Civic Center (City Administration)
h. Energy Distribution: Utility Buildings and other key utility infrastructure components essential for energy delivery, and mobile units

[10] Salem Emergency Management Plan, (Dec 2006) p. 6

2.5.2 Priority 2

a. Transportation Infrastructure (Key City Designated Life Lines)
b. Designated Salem Public Works Facilities and Infrastructure (e.g., water and sewage)
c. Transit Services
d. Communication Facilities (non-emergency response/coordination) – public and private
e. Salem/Keizer School District Administration Office
f. Other Medical Facilities and Red Cross Main Office

2.5.3 Priority 3

a. Mass Care/Shelter Facilities (as designated by Red Cross)
b. Transfer/Recycle Station
c. Designated Salem Public Works Facilities and Infrastructure (e.g., water and sewage)
d. City of Salem Main Library
e. Army Aviation Support
f. National Weather Service
g. Amtrak
h. Salem Airport

2.5.4 Priority 4 -- Other Priority Critical Facilities and Infrastructure:

As designated in coordination with the City and the emergency operation centers, this list should include the category of Nursing Homes, Critical Care Facilities, Special Needs Services, and Senior Centers. Schools in session should also be included here. Additional designated City of Salem Public Works Facilities and Infrastructure (e.g., water and sewage) should be included.

2.6 TYPES OF CRITICAL FACILITIES AND INFRASTRUCTURE

For purposes of this LEAP study, critical facilities and infrastructure are further classified by the following functional types, which can be found in any of the above noted Priority rankings.

- Medical
- Emergency Coordination/Communication
- Emergency Response (First Responders)
- Governance
- Energy
- Drinking Water
- Sewage
- Mass Care and Shelter
- Special Needs
- Communication
- Transportation

For example, the type "Emergency Coordination/Communications" includes the City's EOCs (primary and secondary), 911 Services, and Emergency Dispatch Services in the Willamette Valley Communication Center, the Anderson Readiness Center. This makes

an essential distinction with "Emergency Response/First Responders" type or category that includes Fire and Ambulance services, Police services, and Public Works as noted above (2.5.1 “b” and “d”). Note that the structure commonly known as “City Hall” or the “Salem Civic Center” houses both the City Administration (Type = Governance) as well as Police services. The use of types helps clarify the critical functions involved in any given critical facility or infrastructure.

2.7 Criticalness of Function and Vulnerability of Energy Supplies

There is a distinction between critical function and vulnerability. The critical nature of a facility or infrastructure element is the importance of its functions (and hence the importance of its access to adequate energy supplies) for the protection of human life, health and safety, and the built environment especially other critical community assets. Vulnerability, on the other hand, is the likelihood that the facility’s energy supply will be disrupted or exhausted during an emergency event.

For example, a major hospital is a Priority One Critical Facility because of its critical functions. If its energy supply is disrupted, the health and life of many patients would be immediately threatened, and the facility would quickly lose the ability to provide many emergency services. In addition, costly and vital temperature-sensitive medical supplies could be harmed or even rendered useless. However, that same hospital may not be very vulnerable if it has a solar array and an on-site generator with at least a week’s fuel supply available.

2.8 Data Collection Methodology on Critical Facilities and Infrastructure

2.8.1 Introduction

In order for the Local Energy Assurance Plan (LEAP) to adequately address the energy environment and resilience level of each of its identified critical facilities and infrastructure components, a significant amount of data was collected from City Staff. City-owned facilities and infrastructure were evaluated with both physical and energy security in mind.

A systematic approach was used to assess (1) facilities’ operational energy requirements, (2) energy vulnerabilities, and (3) backup generation capacity. The results of this assessment have been used to populate a Geographic Information System (GIS) database. This spatially-referenced information can to be used as an emergency management tool in the event of an energy disruption, or as a planning tool between emergencies.

When taken together, the resulting data became the basis for facility-specific recommendations for the City of Salem to achieve greater energy resilience.

2.8.2 Data Collection Objectives

a. Identify and inventory Critical Facilities and Critical Infrastructure, ranking these elements into Priority Levels 1-4 (1 = highest priority, 4 = lowest priority) – see sections 2.4 and 2.5 above.

b. Verify and correct information already held by the City of Salem regarding prioritized facilities vital to the recovery of Salem from an energy interruption.
c. Identify energy resources required by high priority facilities to perform critical functions and backup supply of these resources
d. Determine physical and service vulnerability of energy supply connections to identify weaknesses in energy security.
e. Assess availability and capacity of backup power generation and storage needed to perform critical functions.
f. Identify actions for improving facilities' energy resilience and emergency preparedness.

2.8.3 Data collection Methods

Data was collected based on a number of criteria, each pertaining to an element recommended by the Local Energy Assurance PTI Guidelines (see Chapter 1 of this LEAP Report).

a. **Critical Facilities:** Managers of each Priority 1 critical facility were interviewed by Community Planning Workshop team members. Each was asked a series of questions regarding energy resilience of the facilities within their jurisdiction. Each resource provided data specific to their energy emergency preparedness and provided guidance as to appropriate remediation of energy-related weaknesses.
   Data was collected initially through a survey, expert interviews, field visits, and ultimately by Site Survey Sheets (see Technical Appendix II). Each section of the Site Survey Sheet intentionally targeted a particular concern raised by the PTI guidelines in determining the energy resilience of a facility. Energy resources, physical energy assessment, energy backup generation, storage, physical security, and physical building assessments were carried out to identify, document, and provide basis for recommendations surrounding energy assurance. From these various approaches, a variety of types of data were garnered.
   i. **Maximum Allowable Down Time (MAD Time)** was calculated based on the estimation of each facility director based on industry requirements, established City norms, and the nature of each facility's function. The time a facility could maintain functionality without a particular energy input is recorded in hours. Mad Time is essentially the same factor as discussed in Section 2.4.4 above.
   ii. **Energy Inputs** consist of each type of input a facility might use to function. Included in this data set are both essential and non-essential inputs; the former being those resources required to perform critical functions of each facility, the latter being those inputs that are not required for the facility to function. The critical function(s) associated with each input is recorded.

iii. **Backup Power Supply** was measured based on available generation capacity of each facility evaluated. The amount of time each backup power supply available would last is a calculation done by City Staff from each facility, taking into account the amount of electricity required to maintain functionality of each facility. This value is measured in hours.

b. **Critical Infrastructure:** Salem's Critical Infrastructure can be categorized by the type of system of which each utility link is a component. Though all utility links of a Priority 1 network can be considered Priority 1, it is difficult, for example, to isolate the priority of any given pump station. This being understood, each essential infrastructure-based system is taken as a whole, evaluated by the Public Works Department of the City of Salem based on its function and/or service the network provides, and is ranked accordingly.

2.8.4 Data Collection Goal

When the facility-specific information gathering through qualitative data collection is completed for all critical facilities and infrastructure (an ongoing project for the City that will take some time to complete), the City of Salem will have a comprehensive understanding of each critical facility and key infrastructure component and their energy requirements. By identifying weaknesses in each of the aforementioned categories, City Staff will be able to determine the most effective course of action in the event of an energy interruption. This will also hopefully aid in the process of recommending operational and capital improvements aimed at increasing resilience to energy interruptions.

2.8.5 Combined Data Reporting

A number of the City's Critical Facilities (and functions) are co-located in the same building or building complex. Accordingly, some of the information regarding energy resources can be considered nearly identical. With the exception of operational specifics, facilities that are housed in the same building are reported to have the same resources. Critical Facilities that are co-located include: City Hall (Governance) / Police Department (Public Safety and Emergency Response); City Shop #3 Fleet Services Office/ City Shop # 19 Fuel Island; Salem Hospital Family Birth Center (Emergency Response)/ Salem Hospital Center for Outpatient Medicine/ Salem Hospital Winter Street Building; Oregon State Hospital Santiam Hall/ Oregon State Hospital Building 48/ Oregon State Hospital Breitenbush Hall/ Oregon State Hospital McKenzie Hall/ Oregon State Hospital EOLA Building.

2.9 Summary and General Findings on Status of Critical Facilities and Infrastructure

2.9.1 Critical Facilities

A. Findings

Based on the data collected from the thirty-one identified Priority 1 Critical Facilities in the City of Salem, a number of consistencies and trends can be drawn regarding their level of preparedness and resilience.

i. All of the Priority 1 facilities are assumed to require constant functionality, much of which is tied to the availability of electricity. Without this resource, many facilities will be unable to carry out their critical functions during both normal conditions and in a state of emergency response.
ii. Many of Salem's Critical Facilities use electricity to coordinate response and recovery actions, particularly for communications. Lights, heating, and other necessary components for these facilities can often be provided by other means or will only pose significant issues seasonally, such as in cold winter months.
iii. The City of Salem's Priority 1 Critical Facilities are generally well-equipped to endure short-term energy interruptions. Nearly all of the facilities have provisionary diesel generation power. However, few have the capacity to endure a power interruption longer than 24 hours without being refueled.
iv. Few of these Priority 1 facilities have been evaluated by the City to assure their physical security. Additionally, seismic integrity poses a significant threat to many facilities as their building has either been deemed seismically unsound, or has not yet been evaluated.
v. The Majority of Salem's City-owned facilities/utilities are serviced by Salem's own forces from Facilities, Utilities Operations, and/or Fleet Services departments who perform repairs and/or provide fuel.

Table 2.1 shows the results of an evaluation of Priority 1 Critical Facilities in Salem.

TABLE 2.1: SALEM'S PRIORITY 1 CRITICAL FACILITIES								
FACILITY	BACKUP POWER	NATURAL HAZARD SUSCEPTIBILITY	PHYSICAL SECURITY EVALUATION	VIDEO SURVEILLANCE	LOCKED	FENCED	SECURED GENERATOR	SEISMICALLY SOUND
Willamette Valley Communication Center	Diesel	Flood	Y	Y	Y	N	Y	Y
Salem Fire Station 1	Diesel	Erosion	N	N	Y	N	Y	Y
Salem Fire Station 2	Diesel		N	N	Y	N	Y	Y
Salem Fire Station 3	Diesel		N	N	Y	Y	Y	Y
Salem Fire Station 4	Diesel		N	N	Y	N	Y	Y
Salem Fire Station 5	Diesel		N	N	Y	N	Y	Y
Salem Fire Station 6	Diesel		N	Y	Y	N	Y	Y
Salem Fire Station 7	Diesel		N	N	Y	Y	Y	Y
Salem Fire Station 8	None							
Salem Fire Station 9	Diesel		N	N	Y	N	Y	Y
Salem Fire Station 10	Diesel		N	N	Y	N	Y	Y
Salem Fire Station 11	Diesel		N	N	Y	Y	Y	Y
Anderson Readiness Center								
Salem Fire Training	None		N	N	Y	N	N	N
Salem IT Department	Diesel, Battery		Unknown	Y	Y	N	Y	Unknown
Salem City Hall	Diesel		N	Y	Y	N	N	N
Salem Police Department	Diesel		N	Y	Y	N	N	N
Marion County Public Works	Diesel		Y	N	Y	Y	Y	Limited
Salem Hospital Family Birth Center	Diesel		N	Y	Y	N	Y	Limited
Salem Hospital Center For Outpatient Medicine	Diesel		N	Y	Y	N	Y	Limited
Salem Hospital Winter Street Building	Diesel		N	Y	Y	N	Y	Limited
City Shop #3 Fleet Services Office	Diesel	Flood	Unknown	N	Y	Y	Y	Unknown
City Shop #2 Public Works Field Office	Diesel		N	Y	Y	Y	N	N
City Shop #19 Fleet Services Fuel Island	Diesel	Flood	Unknown	N	Y	Y	Y	Unknown
City Shop #24 Radio Communication	Diesel		N	Y	Y	Y	N	Y
Oregon State Hospital Santiam Hall								
Oregon State Hospital Building 48								
Oregon State Hospital Breitenbush Hall								
Oregon State Hospital Mckenzie Hall								
Oregon State Hospital Eola Building								

"Limited" refers to older seismic standards, or one building in a complex being seismically sound.

B. Recommendations

Keeping in mind the broad range of functions and the improvements necessary to increase resilience to the facilities deemed Priority 1 can be made generally. Following are recommendations related to Priority 1 facilities.

i. All Priority 1 Facilities should have backup generation capacity to maintain independent function.

- All generators should be securely located out of hazard zones, guarded by fencing to prevent tampering.
- Maintain provisionary energy storage enough to run operations for at least 48 hours without being refueled.
- This could potentially be achieved by coordinating a common fuel storage scheme to connect facilities in remote areas in the event of an energy interruption.

ii. Communications being the most common electrical dependency, redundancy of communications should be added to the existing communications network between Priority 1 facilities.

- Backup facilities for services such as the Emergency Operations Center and 911 Call Center should have all of the necessary communication equipment on-site, requiring no transfer of computers or servers to the alternate location. (Staff will likely want to transport their lap tops and other readily portable devices such as thumb drives.)
- Network data should similarly be mirrored to secure servers at both the EOC and Backup EOC so that the information will be readily available in the event of an emergency or disconnection with Salem IT.

iii. The City of Salem should perform a security evaluation of all city-owned facilities to assess their resilience to intentional attack.

- Develop a security standard for the City of Salem to assure that Priority 1 facilities are equally prepared across departments for energy emergencies.
- Coordinate with non-City owned facilities to assure appropriate standards are met.

iv. All Priority 1 facilities should be built to resist natural disasters such as flooding, earthquake, fires, etc.

- Critical Facilities should be housed in seismically sound buildings, with retrofitted facilities being slowly phased out or designated for less important City functions.
- The City of Salem should consider ownership, where possible, of all Critical Facilities.

2.9.2 Critical Infrastructure

A. Findings

Based on discussions with City Staff, it was determined that all infrastructure components including utility lines, utility links, and life lines are Priority 1.

B. Recommendations

The complexity of these systems does not obviate prioritization during energy disruptions and energy emergency events. In the interest of providing Salem with a comprehensive analysis of its critical assets (facilities and infrastructure, alike), the following recommendations have been identified at this time.

In light of the importance of Priority 1 systems, UO CSC recommends that Salem Public Works should:

- Perform an evaluation of energy assurance measures for all critical infrastructure including, but not limited to, pump stations, and maintenance facilities, to provide backup generation for **each** link in the Priority 1 system.
- Develop a standard operating procedure for energy emergencies in which utility links are prioritized within each Priority 1 system as to their importance in maintaining the integrity of the system as a whole.

C. Methodological Notes

- In a November 17, 2011, memorandum reviewing the October 19, 2011, penultimate draft of this LEAP report, Public Works staff[11] indicated that the following methodology has been developed and should be used to prioritize infrastructure elements. This methodology has been used to establish project priority for the City's CIP over the past three years.

  1. List assets to be evaluated.
  2. Establish asset criticality, defined as a function of redundancy and breadth of effect of failure.
  3. Establish asset condition as measured against standard failure mode criteria: ability to service demand, physical condition, O&M efficiency, and level of service compliance.
  4. Determine the remaining life, as a function of condition.
  5. Determine the likelihood of failure, defined as a function of remaining life.
  6. Define consequence of failure across social, environmental, economic, and Operation & Maintenance (life/health/safety) criteria.

[11] Vern Hallstead (Operations Maintenance: Willow Lake Wastewater Treatment Facility), Frank Flux (Operations Maintenance: Wastewater Collections), Scott Branch (Operations Maintenance: Pumps and Controls), and Barry Buchanan (Public Works Administration: Utilities Planning).

7. Establish the risk of failure, defined as a function of likelihood of failure and consequence of failure.
8. Rank the risk of failure scores to establish indicative priority of importance.

TECHNICAL APPENDIX I: LIST OF PRIORITY 1 - 4 CRITICAL FACILITIES AND INFRASTRUCTURE

TECHNICAL APPENDIX II: SITE ASSESSMENT DATA

CHAPTER 3: REVIEW OF EXISTING POLICIES AND PROCEDURES

3.1 LEGAL AUTHORITY AND STATUTES

The following is a summary of the legal authority and statutes that provide the foundation for this LEAP and for the City of Salem's response to energy emergencies. Many of these plans relate directly to energy assurance and response in the community and shaped the recommendations in *Chapter 6: Policy and Procedure Recommendations*. While the list of legal authority and statues in this chapter is extensive, it does not include every legal authority and statute reviewed for the LEAP report. Guidelines, statutes, and codes that were reviewed include the PTI Guidelines, Oregon Revised Statutes, Salem Emergency Management Plan, Salem Natural Hazards Mitigation Plan, Salem Revised Code, Salem Comprehensive Plan, Salem Building Code, Salem Community Energy Strategy, and various federal and state regulations relating to energy.

3.1.1 Introduction -- PTI Guidelines

The Public Technology Institute (PTI) of the U.S. Department of Energy publication entitled ***Local Government Energy Assurance Guidelines*** (page 11) indicates that energy assurance plans should include a section referencing and reviewing the appropriate legal authorities empowering the local jurisdiction to act in times of emergencies. The PTI Guidelines state that the goal of such a section in an energy assurance plan is:

> *. . . to clarify and document exactly what authority the jurisdiction has to implement the strategies that are outlined in the plan. . . Understanding exactly what the jurisdiction can and cannot do from a legal perspective in an emergency will help avoid most legal repercussions. Both the state and federal governments have specific mandates in relation to emergency management systems during a proclaimed disaster or emergency. The national mandate is the National Incident Management System (NIMS) as described in the National Response Framework. A local government plan should provide a section that documents how the plan complies with these and any other applicable mandates.*

The U.S. Department of Energy publication ***Local-Level Energy Assurance Framework: 10 Steps to Build a Plan,*** designed as an aide to help implement the PTI Guidelines to write Local Energy Assurance Plans, lists as the second step *"Know Your Emergency Legal Authorities: Understand the Legal Frameworks under Which Your Planning/Response Efforts Will Operate."*

3.1.2 2009 Oregon Revised Statutes – Chapter 401

Chapter 401 of the Oregon Revised Statutes establishes the legal authority for emergency management and services for the state of Oregon as well as all counties and incorporated cities within the state. Section 401.305 sets forth the legal authority for emergency management by counties and cities.

401.305 Emergency management agency of city or county; emergency program manager; coordination of emergency management functions.

(1) Each county of this state shall, and each city may, establish an emergency management agency which shall be directly responsible to the executive officer or governing body of the county or city.

(2) The executive officer or governing body of each county and any city which participates shall appoint an emergency program manager who shall have responsibility for the organization, administration and operation of such agency, subject to the direction and control of the county or city.

(3) The local governing bodies of counties and cities that have both city and county emergency management programs shall jointly establish policies which provide direction and identify and define the purpose and roles of the individual emergency management programs, specify the responsibilities of the emergency program managers and staff and establish lines of communication, succession and authority of elected officials for an effective and efficient response to emergency conditions.

(4) Each emergency management agency shall perform emergency program management functions within the territorial limits of the county or city and may perform such functions outside the territorial limits as required under any mutual aid or cooperative assistance agreement or as authorized by the county or city.

(5) The emergency management functions shall include, as a minimum:

(a) Coordination of the planning activities necessary to prepare and maintain a current emergency operations plan, management and maintenance of emergency operating facilities from which elected and appointed officials can direct emergency and disaster response activities;

(b) Establishment of an incident command structure for management of a coordinated response by all local emergency service agencies; and

(c) Coordination with the Office of Emergency Management to integrate effective practices in emergency preparedness and response as provided in the National Incident Management System established by the Homeland Security Presidential Directive 5 of February 28, 2003.

401.307 Emergency management agency appropriation; tax levy.

(1) Each county and city may make appropriations, in the manner provided by law for making appropriations for the expenses of the county or city, for the payment of expenses of its emergency management agency and may levy taxes upon the taxable property within the county or city.

(2) An appropriation made under subsection (1) of this section shall be budgeted so that it is possible to identify it as a distinguishable expense category.

401.309 Declaration of state of emergency by city or county; procedures; mandatory evacuations.

(1) The governing body of a city or county in this state may declare, by ordinance or resolution, that a state of emergency exists within the city or county. The ordinance or resolution must limit the duration of the state of emergency to the period of time during which the conditions giving rise to the declaration exist or are likely to remain in existence.

(2) A city or county in this state may, by ordinance or resolution, establish procedures to prepare for and carry out any activity to prevent, minimize, respond to or recover from an emergency. The ordinance or resolution shall describe the conditions required for the declaration of a state of emergency within the jurisdiction.

(3) An ordinance or resolution adopted under subsection (2) of this section may designate the emergency management agency, if any, or any other agency or official of the city or county as the agency or official charged with carrying out emergency duties or functions under the ordinance.

(4) A city or county may authorize an agency or official to order mandatory evacuations of residents and other individuals after a state of emergency is declared under this section. An evacuation under an ordinance or resolution authorized under subsection (2) of this section shall be ordered only when necessary for public safety or when necessary for the efficient conduct of activities that minimize or mitigate the effects of the emergency.

(5) Nothing in this section shall be construed to affect or diminish the powers of the Governor during a state of emergency declared under ORS 401.165. The provisions of ORS 401.165 to 401.236 supersede the provisions of an ordinance or resolution authorized by this section when the Governor declares a state of emergency within any area in which such an ordinance or resolution applies.

401.315 City or county authorized to incur obligations for emergency services; county determination of emergency.

In carrying out the provisions of this chapter, counties or cities may enter into contracts and incur obligations necessary to mitigate, prepare for, respond to or recover from an emergency or major disaster. A county shall assess whether an emergency exists.

401.335 Temporary housing for disaster victims; political subdivision's authority.

Any political subdivision of this state is expressly authorized to acquire, temporarily or permanently, by purchase, lease, or otherwise, sites required for installation of temporary housing units for disaster victims, and to enter into arrangements necessary to prepare or equip such sites to utilize the housing units.

3.1.3 November 2009 City of Salem Revised Code (SRC): Chapter 2.6 Emergency Management

Chapter 2.6 of the City of Salem Municipal Code establishes the legal authority for emergency management and services within the City. Sections 2.660 – 2.680 set forth the legal authority for emergency management within the City.

SRC 2.660. Creation of Emergency Management Agency; Definitions.

(a) Pursuant to ORS 401.305 there is hereby created within the City an Emergency Management Agency to be under the direction of the Emergency Program Manager.

(b) The Emergency Management Agency shall, in addition to the Emergency Program Manager, be staffed by such employees of the various departments of the City as may be designated by the Emergency Program Manager pursuant to the plan adopted pursuant to SRC 2.675.

(c) The definitions set forth in ORS 401.025 apply to terms used in SRC 2.460-2.480.

(d) The Emergency Program Manager shall be the City Manager or, in the absence of the City Manager, the person designated to succeed the City Manager in the plan adopted under SRC 2.675. (Ord No. 50-88; Ord No. 51-96; Ord No. 8-98; Ord No. 42-09)

SRC 2.665. Powers of Agency.

The provisions of ORS Chapter 401 relating to emergency management and services are intended to enable local response to emergencies notwithstanding provisions of local charter and ordinance which would otherwise inhibit such response. The emergency management agency shall, therefore, have and exercise all powers granted to such agencies under applicable provisions of ORS Chapter 401, notwithstanding any contrary provision of the Salem Revised Code or the Charter of the City of Salem. (Ord No. 50-88; Ord No. 42-09)

SRC 2.670. Declaration of a State of Emergency.

(a) The emergency program manager is authorized to determine and declare a state of emergency to exist when an emergency has occurred or is threatened to occur within the city.

(b) The declaration shall do all of the following:

(1) State the nature of the emergency.

(2) Describe the location or geographic area affected. 23 11/2009

(3) Describe emergency conditions or threatened emergency conditions.

(4) Describe damage or potential damage, if any.

(5) Describe the resources committed and actions initiated by the city to alleviate the situation. (Ord No. 8-98; Ord No. 42-09)

SRC 2.675. Emergency Management Plan.

(a) The city manager shall adopt, and may revise from time to time, a plan for response to emergencies directly or indirectly involving the city; and for provision of emergency services, both directly and in coordination with other public and private agencies.

(b) Such plan shall include provisions for temporary reassignment of city personnel, equipment and supplies to emergency services functions under lines of authority designated in the plan; for the emergency acquisition of necessary equipment, materials and services; and for the assignment of duties relating to pre-planning, training, and on-going support for the emergency management agency.

(c) Upon adoption of and any amendment to the plan, the emergency program manager shall file a copy with the city recorder for the information of the council. (Ord No. 50-88; Ord No. 8-98; Ord No. 42-09)

SRC 2.680. Emergency Orders.

(a) Whenever a state of emergency is declared to exist within the City, the Emergency Program Manager is empowered to order any of the following measures when necessary for public safety or when necessary for the efficient conduct of activities that minimize or mitigate the effects of the emergency:

(1) Redirecting City funds for emergency use and suspending standard City procurement procedures.

(2) Establishing a curfew which fixes the hours during which all persons other than officially authorized personnel may not be upon the public streets or other public places.

(3) Prohibiting or limiting the number of persons who may gather or congregate upon any public street, public place, or any outdoor place.

(4) Barricading streets, prohibiting vehicular or pedestrian traffic, or regulating such traffic on any public street leading to the emergency area for such distance as may be deemed necessary under the circumstances.

(5) Mandatory evacuation of persons, which shall be enforceable by peace officers, fire officials, and firefighters.

(6) Curtailing or suspending commercial activity.

(7) Such other measures as are necessary for the protection of the public health, safety or welfare, or for the recovery from the emergency.

(b) The City Manager may delegate authority to order the measures described in subsections (a) (4) and (5) of this section to City personnel in the plan adopted as provided in SRC 2.675.

(c) Within ten days of the date of the order, any person aggrieved by an emergency order may request a hearing before the Municipal Court to determine whether issuance of the order was an abuse of discretion. The Municipal Court shall hear the matter within thirty days of the request for hearing.

(d) Failure to obey an emergency order is a misdemeanor. (Ord No. 8-98; Ord No. 42-09)

3.1.4 December 2006 Salem Emergency Management Plan (SEMP)

The December 2006 Salem Emergency Management Plan (SEMP) embodies the legal emergency management authority into a pragmatic operational framework designed to cover all hazards and all phases of emergency management. The SEMP is designed to be in compliance with national emergency management policies (e.g., NIMS and Homeland Security mandates), and ORS Chapter 401, as well as the Salem Revised Code.

A. AUTHORITY

Under provisions of ORS Chapter 401, the City of Salem Charter, and the Salem Revised Code (SRC 2.1135-2.1158), the responsibility and authority for emergency management functions of city government are vested in the city manager or designated successor.

B. PURPOSE

This plan describes the City of Salem's basic concept of operations for management of emergency situations as defined in this plan, establishes an organizational structure for use in such situations, and assigns functional responsibilities for essential services. The plan may be used when emergency circumstances exceed the capabilities of a single response agency or when city response must be coordinated over multiple city departments.

In such situations, the city has a critical need to gather information, to evaluate it, and then to coordinate the response of resources from within the city and to request necessary additional resources through the county from state and federal governments. The Emergency Operations Center (EOC) outlined in this plan will oversee these tasks for the entire city's resources.

This plan provides a general framework for organization and coordination of the city's emergency response. The responsible management individuals of a particular emergency situation must apply experience and informed judgment when dealing with any particular set of emergency circumstances.

C. OBJECTIVE

The objective is to provide effective emergency management capabilities within the City of Salem to minimize the loss of life, protect the environment, and preserve property by making effective and efficient use of available work force, equipment and other resources.

F. CONCEPT OF OPERATIONS

Upon notification of a pending or an actual emergency, the emergency program manager will determine whether the situation requires extraordinary measures for control and protection of the city. If extraordinary measures are required, the emergency program manager may order the activation of this plan and the Emergency Operations Center (EOC). City department directors will mobilize their staff and resources in accordance with this plan.

The city will follow a strategy of centralized planning and decentralized execution in preparing for and responding to emergencies. This strategy means that the city prepares the overall plan for response to the emergency, establishes the organization of the response, sets priorities, and marshals and allocates resources to field response forces. Emergency response forces will be organized in accordance with the National Incident Management System, Incident Command System (NIMS). Typically, emergency response forces will be organized into one or more incident or area commands. Incident/area commanders direct these resources in the field to resolve emergency situation. City departments provide resources through the EOC for commitment to incident/area commanders in the field. The overall city emergency response is managed and

coordinated from the EOC. Annex C describes the duties and responsibilities of the individual components of the EOC organization.

3.1.5 2008 Salem Natural Hazards Mitigation Plan (NHMP)

On August 25, 2008, the Salem City Council formally adopted the *2008 Salem Natural Hazards Mitigation Plan*. This June 2008 update of the June 2002 and May 2003 plans was also approved by The Oregon Office of Emergency Management (OEM) and Federal Emergency Management Agency (FEMA) Region X.

The general purposes of the Salem Natural Hazard Mitigation Plan are to: (1) define the scope of and experience with natural hazards affecting the community; (2) assess the ongoing hazard mitigation activities in the community, including approaches that the City is currently utilizing; (3) evaluate additional mitigation measures that should be undertaken; (4) define a strategy for implementation of mitigation projects and activities by all stakeholders (including cities, the County, citizens, businesses, others); (5) serve as a qualifying document for various hazard mitigation programs which are coordinated through the Office of Oregon Emergency Management (OEM); and (6) act as a resource document, subject to change, as the community refines hazard mitigation goals, strategies, and implementation.

The Salem NHMP includes numerous Mitigation Action Items tailored to address the Hazards assessed in the Plan. Critical facilities are cited as a major concern throughout the plan and are a focus of several of the Action Items. Specifically, Critical facilities are addressed in: Multi-Hazard Action Items #1 (p.46), #2 (p. 47), #4 (p. 49), #11 (p.56), and #12 (p.57); Earth Quake Action #1 (p. 64), #2 (p. 65), and #3 (p. 66); and, Mitigation Plan Implementation Action #5 (p. A-16), #6 (p. A-17), and #16 (p. A-28). The Salem Local Energy Assurance Plan (LEAP) addresses and implements in part the above noted Action Items from the Salem NHMP, and is thus partially fulfilling the mandate of the August 25, 2008 action of the Salem City Council.

3.2 Existing Pattern and System of Authority and Response During Power Disruptions

3.2.1 Current Relationships Between City and Energy Utilities During Energy Emergencies[12]

"Historically, when electrical failures are experienced during winter snow and ice storms [the City's] level of interaction with the utilities increases exponentially. [The City] attempt[s] to interface with both PGE and Salem Electric in any fashion that is reasonable. [The City has] taken steps to send a liaison directly to their offices in order to triage or affect efficient and effective communications between their offices and ours. The results could have been much better.

[12] The information in this section was provided by Roger Stevenson, City of Salem Emergence Preparedness Manger (City of Salem Fire Department), in an August 12, 2011 email memorandum.

Recently, [The City has] been able to affect some changes in the method of communication between Willamette 911 and the utilities. [The City is] now using an internet email situation in lieu of the old fax system that was not effective.

Collaboratively, the City of Salem GIS and PGE IT is working on a project that will allow a data feed to be assimilated by our SAFE system into a common operating picture for responders. This will eventually, give the City of Salem a GIS map of the response units from PGE. This will be more efficient and lessen the duplicate response to the same incident calls.

Improvements are occurring toward greater efficiencies in the future.

Natural gas and motor fuels have not been an issue up to this point."

3.2.2 Power Supply Monitoring by the City of Salem[13]

The following is a description of the City of Salem's Monitoring, Instrumentation, Control, Automation, and Reporting (MICAR) updating systems for infrastructure and the City in general:

". . . there are two different, but related processes: (1) PGE gives us live updates on power outages and power emergencies; and (2) internally we have monitoring that reports status and disruptions. The following is a brief description of those systems.

PGE data is imported into the GIS database every 15 minutes. This information is processed into secure web servers, which communicate the information to SAFE. The information includes power outage locations and status.

Notification at this time will be by looking at the visualization in SAFE, no auto notifications are currently available. GIS users have access to the data through ArcGIS Desktop for EOC purposes. The Supervisory Control and Data Acquisition system (SCADA) do not currently talk to GIS.

However, the City of Salem utilizes a SCADA to communicate and/or control various functions at water and sewer facilities; pumps stations, reservoirs etc.

The SCADA system utilizes a main computer system that constantly communicates with all of the system facilities. The SCADA system is programmed to control certain functions of the water and sewer systems based mainly on pre-programmed set points while other aspects are simply monitored for levels, pressures, and state of operation. Other functions are made manually in the SCADA system which then communicates that to the appropriate facility. Radio communication is used at most facilities although some older sites still utilize a phone line data system. The radio system communicates with all of the sites approximately every 30 seconds. The phone system is approximately every 3 minutes. Alarm conditions at facilities take priority and are usually received no less than 5 seconds after an alarm condition is created.

Once an alarm is communicated to the SCADA system, an alarm is created the alarm manager and is displayed for the dispatch center to review and silence. The dispatch center enters the alarm into their daily log and the alarm is also printed out in an alarm

[13] The information in this section was provided by Barry Buchanan, P.E., Strategic Planning Section Senior Utilities Planning Project Manager ,City of Salem Public Works Department, in a July 20, 2011 memorandum entitled "Power Supply Monitoring."

manager printer the secure SCADA room. After dispatch has read the alarm and determined the proper protocol, the alarm is generally relayed to crews in the field to respond to. During emergency conditions such as storms or other high priority events, these alarms are also manually entered into the City of Salem SAFE system.

PGE provides electrical power to Willow Lake Water Pollution Control (WLWPCF) from two separate electrical substations. Wallace Road substation is the Preferred Source and Indian West is the Standby Source. Transfer control from Preferred Source to Standby Source and back again is automatic.

PGE power is monitored by the Invensys/Foxboro IA Distributed Control System (DCS). All wastewater process instrumentation monitoring and control throughout WLWPCF is performed by the DCS. Priority alarms for electrical power and the wastewater process are alarmed on the DCS and on the 800 MHZ City radio's providing immediate notification to the Operational staff. All alarms are sent to an alarm printer and are stored in the DCS Historian.

PGE power to River Road Wet Weather Treatment Facility (RRWWTF) is configured identical to WLWPCF being fed from two separated electrical substations with the same type of automatic control. All PGE power is monitored by DCS. All wastewater process instrumentation monitoring and control at RRWWTF is performed by the DCS locally and remotely via a T1 communication line to Willow Lake. All alarms are indicated at RRWWTF and at WLWPCF and are sent to an alarm printer and stored in the DCS Historian.

Electricity at City Hall and the Main Library is monitored through "Hawk-Eyes" attached to each electrical control panel. This information is fed in the City's Building Automated System (BAS) and is tracked. The BAS also controls the HVAC and lighting systems at those locations allowing for adjustments in each systems operational functions. The information that is collected, is transferred into an excel spread sheet for financial analysis. Other locations that are equipped with our BAS system are: Center 50+, Chemeketa Parkade, Liberty Parkade, 295 Church (CCTV & IT), Fire Stations, 1, 5, 7, 10, 11."

3.2.3 City Standard Operating Procedures for Energy Disruptions[14]

Salem's current Standard Operating Procedures (SOPs) for Facilities Services Buildings are as follows:

1. *For facilities **with** backup power:*

   The generator automatic transfer switch (ATS) automatically transfers building load to generator and back to utility after service has been restored. When the generator is running under building load, Facilities monitors running conditions and fuel levels. If required Fleet Services fills diesel tanks.

2. *For facilities **without** backup power:*

   Await utility power to be restored, if excessive outage is estimated by the electric utility company a portable generator set may be installed by our electrical Contractor of Record.

3. *Steps to be taken to restore power to these facilities:*

   Confirmation if outage is utility (PGE or Salem Electric) or a local failure in our switch gear equipment. If the failure is utility, then the proper one is notified for repair. If the failure is the Cities equipment then our Electrical Contractor of Record is notified for corrections.

3.2.4 Community Energy Strategy

The existing City plan addressing energy efficiency and consumption is the *2010 Salem Community Energy Strategy.* As a complementary plan to the *Municipal Energy Strategy,* both *Strategies* focus on reducing energy use and greenhouse gas emissions in municipal facilities and the greater community. The *Salem Community Energy Strategy* aims to improve long-term energy efficiency by providing financial assistance and technology support. One of the objectives is to advocate for the use of renewable energy while decreasing total energy consumption. The *Salem Community Strategy* identifies five goals:

1. Improve energy efficiency in buildings community-wide.
2. Increase renewable energy used or produced by Salem residents and businesses, while decreasing total energy consumption.
3. Create and support a viable and diverse transportation network that focuses on moving people.
4. Position Salem as a leader in sustainable industry.
5. Conduct a public participation program that engages the community and communicate the value of energy savings and greenhouse gas reduction community-wide.

[14] The information in this section was provided by Luke Bergerson, City of Salem Facilities Services Division, in an email memorandum on August 16, 2011. This memorandum references *Facilities Services Operations SOP binder located at Shops Building # 24.*

The Strategy also outlines actions for Salem to take in order to achieve these goals. Many of these may have relevance for Salem's LEAP efforts, including:

- Establish a loan fund to provide upfront financing for energy efficient lighting upgrades (in commercial buildings);
- Construct LEED or equivalent "green standard" City buildings;
- Provide incentives to reduce permit fees for buildings that exceed state energy code and/or incorporate renewable energy generation;
- Review building code to recommend/encourage installation of renewable energy generation, including solar, wind, and hydroelectric;
- Establish energy districts designed to meet their own energy needs and finance construction for energy systems;
- Promote participation in "green power programs" such as the PGE Green Electric program;
- Collaborate with PGE to become a smart grid pilot community;
- Expand Salem's use of low-head hydroelectric turbines; and
- Develop a marketing plan and educational materials to promote energy savings programs and sustainability.

3.2.5 Comprehensive Plan

The *2005 Salem Area Comprehensive Plan* is a long-range plan for guiding development in the Salem urban area and its relationship with Salem/Keizer urban area for the next 20 years. The goal of the Plan is to accommodate development in a timely, orderly and efficient arrangement of land uses and public facilities and services that meet the needs of present and future residents of the Salem urban area.

The *2005 Salem Comprehensive Plan* also provides design guidelines for new development and redevelopment to optimize the use of natural resources, alternative energies, tools and techniques. The energy-related polices outlined in the plan are as follows:

- The City and counties should consider and foster the efficient use of energy and the utilization of solar energy, wind power, on-site conversion of clean fossil fuels[15] to electricity, and other renewable alternatives in land and transportation planning. [16]

[15] Clean Fossil Fuel energy is energy production from fossil fuels with minimal release of greenhouse gases (GHG).
[16] City of Salem, *Salem Area Comprehensive Plan*, 2005.

- The utilization of renewable energy sources shall be encouraged during the development and operation of all industrial activities. New industries that utilize energy most efficiently or that manufacture products that contribute to efficient use of energy should be encouraged.[17]
- The transportation facilities shall be designed to minimize noise and energy consumption as well as to encourage public transit, biking and walking.[18]

3.2.6 Salem Revised Code

The Salem Revised Code (SRC) is concerned with many of the building safety elements of energy-related topics. The following sections are relevant to the Salem LEAP:

- Chapter 2.815 Administration: Lists "Leadership in Energy and Environmental Design (LEED) Certification by the Green Building Council" as a Public Benefit of the Multiple-Unit Housing Tax Incentive Program.
- Chapter 35 Public Utilities: Provides general regulations for the installation of power and communication systems including gas, electric, telegraph, telephone, and underground utilities.
- Chapter 47 Solid Waste Management: Refers to "resource recovery" as an opportunity to remove certain physical or chemical by-products that can be used for energy production.
- Chapter 56 Building Code: Defines and details procedure from permitting to inspection of any construction to assure it adheres to "State Building Code," specifically including Oregon Specialty Electrical Code (Ord. No. 62-05). Chapter 64.020 Comprehensive Planning: Explains the intent and purpose of creating a "framework for land use and development" to coordinate the multitude of City plans in compliance with ORS Chapter 197.
- Chapter 69.060 Landslide Hazards: Provides "Classification Criteria and Review Requirements" for proposed activities on landslide hazard areas.
- Chapter 117 Conditional Uses: Specifies when a conditional use may be permitted, and the conditions thereof.
- Chapter 130.200-220 General Development Standards: Specifies height limitations and exceptions, particularly as it relates to geographic location of the building in question.
- Chapter 143C.010 Fairview Mixed Use Zone: The Fairview Mixed Use (FMU) Zone has stood as Salem's innovative sustainable design code. The FMU zone emphasizes energy conservation in its building design. Pringle Creek Community is Salem's preeminent example of FMU zoning.
- Chapter 161.020 Employment Centers: Permits energy production on-site within the category (b) Manufacturing and Production.
- Chapter 162.040 South Waterfront Mixed Use: Permits energy production on-site within the category (f) Manufacturing and Production.

[17] City of Salem, *Salem Area Comprehensive Plan*, 2005.
[18] City of Salem, *Salem Area Comprehensive Plan*, 2005.

Sections mentioned above represent areas where the City of Salem addresses regulation related to emergency management as well as development standards that guide development and shape the way Salem operates collectively.

The primary concern of LEAP regarding the SRC is regulation facilitating and/or inhibiting the installation of alternative energy strategies. Following discussions with Salem Development Services, it became apparent that renewable technology is not a topic addressed by the Salem Revised Code.[19] Though the SRC deals with details of interest regarding the requisite development standards and zoning, it only mentions renewable technology (namely, solar technology) in SRC 130 as an exception to general development standards.

3.2.7 Federal and State Regulations (regarding energy)

In reaction to a major power outage in August of 2003 which impacted approximately 50 million people and 61,800 megawatts of electric load throughout the Midwest, Northeast, and portions of Canada, it became apparent to many federal agencies that suggested North American Reliability Commission's (NERC) standards were not being met by transmission providers of the Bulk Electric System.

The U.S. Federal Energy Regulation Commission approved "mandatory, enforceable Reliability Standards within the United States" in accordance with the provisions of section 215 of the Federal Power Administration. "The term 'reliable operation' means operating the elements of the Bulk-Power System within equipment and electric system thermal, voltage, and stability limits so that instability, uncontrolled separation, or cascading failures of such system will not occur as a result of a sudden disturbance, including a cybersecurity incident, or unanticipated failure of system elements."[20]
The adoption of section 215 did the following:

- North American Electric Reliability Corporation (or any other appointed acting Energy Reliability Organization) has developed, and is charged with enforcing, a comprehensive set of Reliability Standards;
- Comprehensive maintenance of reliable operation of each of the elements of the Bulk Power System (this includes both the facilities and control systems necessary for operating an "interconnected electric energy transmission network" or any portion thereof) is required; and
- "The failure of one such component may adversely affect the ability of the operators of other components within the system to maintain reliable operation of the facilities within their control" has been acknowledged by the NERC.[21]

[19] Phone conversation with Aaron Panko, Associate Planner, City of Salem. 2 Aug 2011
[20] 16 United States Code, 824o(a)(4).
[21] *Ibid*, 824o(a)(5).

The adoption of section 215 serves to reinforce the imperative for maintaining and enhancing the resilience of infrastructure related to carrying electricity in a cost effective way. Likewise, the definition of reliability includes developing "the various procedures that might be used in case of an emergency outage to minimize the public disruption and economic loss."[22]

[22] 16 United States Code, 824o(a)(2)

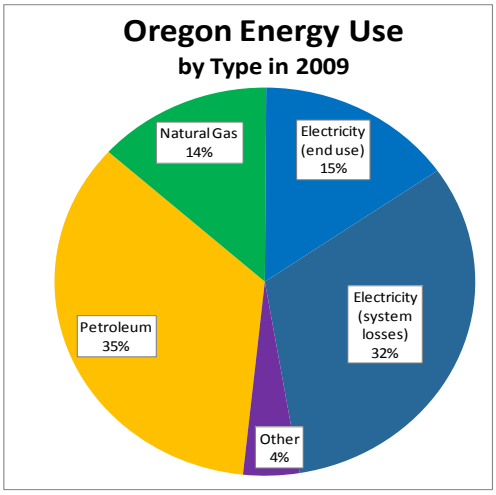
CHAPTER 4: SALEM COMMUNITY FUEL AND ENERGY PROFILE
PART I: SALEM AND ENERGY IN OREGON

4.1 OVERVIEW

Oregon accounts for about 1% of the nation's energy consumption. According to the U.S. Energy Information Administration (EIA), Oregon consumed about 1,105 trillion British thermal units (BTUs) of energy in 2008.[23]

Oregonians are fairly energy efficient, consuming about 279 million BTU per capita in 2009. This ranks Oregon 35th in terms of per capita energy consumption by U.S. states.[24] However, Oregon only produces about 40% of the energy it uses, or 400 trillion of the 1,000 trillion BTU consumed in 2009.[25]

FIGURE 4.1:



Source: U.S. Energy Information Administration

Of the energy Oregon consumes, about half is in the form of electricity or fuel for generating electricity. Another third is in the form of petroleum, primarily for vehicle fuel. The remainder is natural gas for heating, cooking, and other purposes, and a handful of other energy sources such as solar thermal and biomass burned for heat. **Figure 4.1** shows the overall breakdown of energy consumption in Oregon in 2009; **Figure 4.2** further breaks down Oregon's energy consumption by end-use sector.[26]

Oregon's production is almost entirely in the form of electricity from renewable sources -– mostly hydroelectric, with a small amount of wind, biomass, and other sources. Without any significant fossil fuel reserves, Oregon imports almost all of the petroleum, natural gas, and goal it uses to meet its transportation, heating, and electricity demands.[27]

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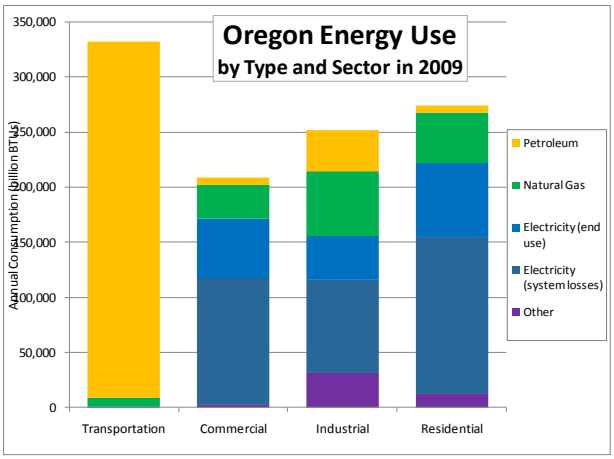
[23] Oregon Department of Energy, *Oregon State Energy Assurance Plan* (Salem: Oregon Department of Energy, 2011).
[24] U.S. Energy Information Administration, *State Energy Data System* (Washington, DC: U.S. Energy Information Administration, 2011).
[25] U.S. Energy Information Administration, *State Energy Data System* (Washington, DC: U.S. Energy Information Administration, 2011).
[26] U.S. Energy Information Administration, *State Energy Data System* (Washington, DC: U.S. Energy Information Administration, 2011).
[27] Oregon Department of Energy, *Oregon State Energy Assurance Plan* (Salem: Oregon Department of Energy, 2011).

The City of Salem produces little to no energy of its own, and consumes almost all of its energy in one of three end-use forms: petroleum, natural gas, and electricity.

This profile describes the state and local consumption of each of these three forms of energy, outlines the energy supply chain, and notes potential supply vulnerabilities.

FIGURE 4.2



Source: U.S. Energy Information Administration

4.2 PETROLEUM

The petroleum supply chain consists of extracting crude oil, transporting it to refineries, processing it into petroleum products, and finally transporting it to consumers, often via intermediate suppliers. After being extracted, crude oil is refined into a number of petroleum products, including:

- **Motor fuel**, primarily gasoline;
- **Distillate fuel**, including diesel fuels, industrial fuels, and heating fuels;
- **Liquefiable Petroleum Gas**, including ethane, propane, butane, and others;
- **Jet fuel**, used in aircraft engines;
- **Residual fuel oil**, a by-product of the refinement process often used to produce heat or electricity; and
- Other products such as asphalt, kerosene, and lubricants.

4.2.1 Consumption

Oregon consumed about 68.4 million barrels of petroleum products in 2009[28], or about 18 barrels per capita. This is slightly less (roughly 18%) than the per capita U.S. average of 22 barrels per year.

Direct consumption data is not available on a city scale, but based on Oregon's per capita rate of consumption, the City of Salem can be estimated to consume about 7 million barrels per year (metropolitan area) or 2.8 million barrels per year (City proper). Of this fuel, the majority (54%) is gasoline, and most of the rest (27%) is diesel or other distillates. **Table 4.1** outlines annual petroleum consumption for the U. S., Oregon, and estimated petroleum use for Salem.

[28] U.S. Energy Information Administration, *State Energy Data System* (Washington, DC: U.S. Energy Information Administration, 2011).

Table 4.1: Annual Petroleum Consumption

	U.S.	Oregon			Salem	
	per cap. (brls/yr)	per cap. (brls/yr)	total (million brls/yr)	% of total	metro area (million brls/yr)	city proper (million brls/yr)
TOTAL	**22.2**	**17.9**	**68.41**	**100.0%**	**6.98**	**2.76**
Motor Fuel	10.6	9.7	37.01	54.1%	3.77	1.49
Distillates	4.3	4.9	18.60	27.2%	1.90	0.75
Jet Fuel	1.6	1.7	6.53	9.5%	0.67	0.26
Residual Fuel Oil	0.6	0.2	0.92	1.3%	0.09	0.04
LPG	2.4	0.5	1.79	2.6%	0.18	0.07
Other	2.6	0.9	3.57	5.2%	0.36	0.14

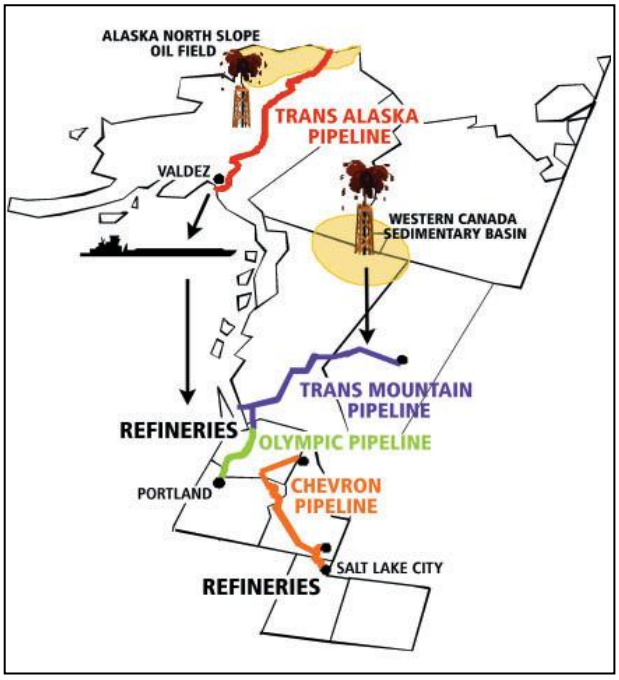
Source: Energy Information Administration

4.2.2 Supply and Distribution

Oregon does not have any crude oil resources or refineries, and so must import all of its petroleum products. Most is extracted and refined regionally – 90% of Oregon's petroleum products are refined in the Puget Sound area of Washington and 80% of the crude oil used to make these products comes from Alaska's North Slope oil fields.[29] The remainder of Oregon's petroleum comes primarily from refineries in Utah and British Columbia.

Most of Oregon's oil enters on tanker ships at the Port of Portland, and is then distributed via tanker truck or via the Kinder-Morgan pipeline, which runs from Portland south to Eugene. **Figure 4.3** shows the Northwest's regional petroleum supply system. Although the Kinder-Morgan pipeline passes through Salem, it does not have an outlet there; Salem receives its petroleum via tanker truck.

FIGURE 4.3: NORTHWEST'S REGIONAL PETROLEUM FUEL SUPPLY SYSTEM

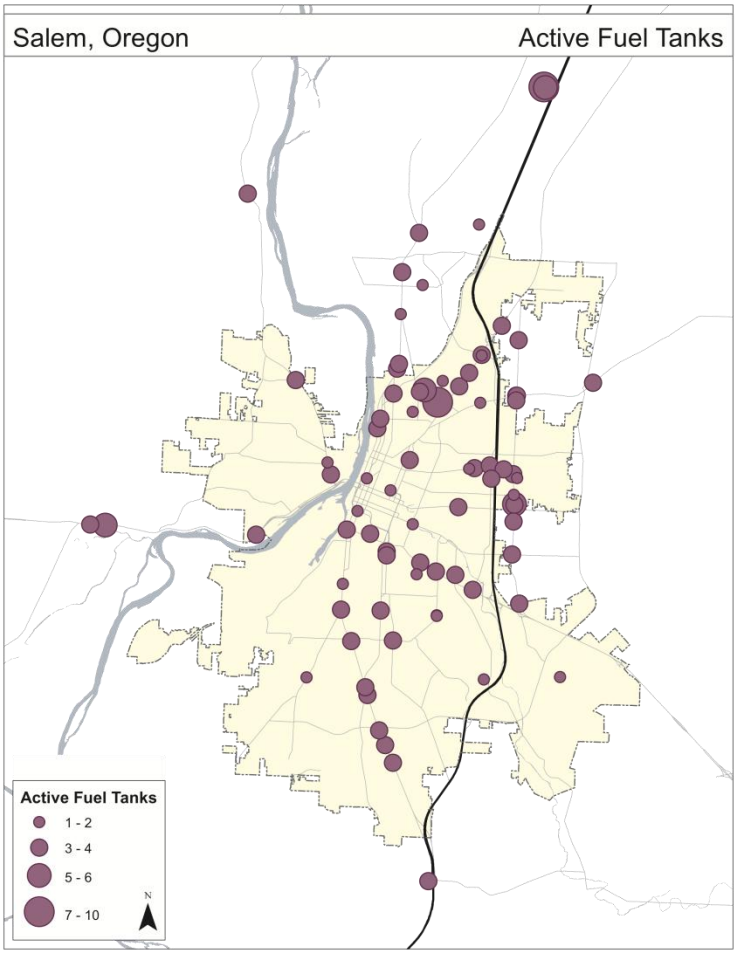


Source: Oregon Energy Assurance Plan

[29] Oregon Department of Energy, "Nuclear and Energy-Related Emergency Preparedness" www.oregon.gov/ENERGY/.../emergency_preparedness_fact_sheet.p.

About 25 companies deliver fuel to Salem's gas stations, businesses, and other fuel consumers.[30] Once it arrives, this fuel is stored in 249 underground fuel storage tanks, distributed at 80 locations throughout the Salem-Keizer area (see **Figure 4.4**).[31] These tanks have an estimated average capacity in the 10,000-15,000 gallon range, suggesting that the area has roughly 2.5-3.7 million gallons of fuel storage capacity. The actual amount of fuel stored in Salem at any given time will depend on the fill levels of these tanks.[32,33] To put these numbers in context, a typical gas station stores between 25,000 and 40,000 gal on-site, and sells about the same amount per week.[34] Furthermore, based on these total storage estimates and estimates of Salem's rate of fuel use, Salem likely has about 36 hours to 5 days worth of fuel storage available at any given time.[35,36]

FIGURE 4.4: UNDERGROUND FUEL STORAGE IN SALEM, OR



Furthermore, the Sequential Biofuels plant in Salem usually has about 200,000 gallons of biodiesel stored on-site, and has a maximum storage capacity of 400,000 gallons. Sequential produces about 500,000 gallons of biodiesel per month, but relies heavily on the electrical grid (and inputs of used oil from local manufacturers) to maintain that production.

[30] Dan Paull, ODOT Fuels Tax Group, personal email, 8 July 2011.
[31] Oregon Department of Environmental Quality, *UST Facilities by Zip Code List* (Salem: Oregon Department of Environmental Quality, 2011).
[32] Oregon Department of Environmental Quality, *UST Facilities by Zip Code List* (Salem: Oregon Department of Environmental Quality, 2011).
[33] Richard Reiter, Oregon DEQ, personal conversation, 12 July 2011.
[34] Oregon Department of Energy, *Oregon State Energy Assurance Plan* (Salem: Oregon Department of Energy, 2011).
[35] U.S. Energy Information Administration, *State Energy Data System* (Washington, DC: U.S. Energy Information Administration, 2011).
[36] Oregon Department of Environmental Quality, *UST Facilities by Zip Code List* (Salem: Oregon Department of Environmental Quality, 2011).

4.2.3 Vulnerabilities

Oregon's petroleum supply system has a number of vulnerabilities that pose a risk to Salem. First, there is the possibility for disruption of the transmission system: the pipelines are 30 years old, and tanker trucks rely on the road network.

Storage could act as a buffer against supply fluctuations, but there is also limited storage. According to the Oregon State Energy Plan, "the Valdez terminus of the Trans Alaska Pipeline System, which supplies 80 percent of the petroleum used in Oregon, can only store up to 386 million gallons of crude oil. This represents, at most, one week of the main pipeline's current output.[37]" Furthermore, the Puget Sound refineries have been operating at over 95% capacity for the past ten years, so there is little room for error if the refineries' production rate drops unexpectedly. The Portland area maintains less than one month of petroleum supply, although further storage (in smaller amounts) can be found in Eugene, Medford, Bend, Pendleton, Coos Bay, Newport, and Astoria.

In the case of a petroleum supply disruption the Oregon Petroleum Contingency Plan (OPCP) will go into effect. The OPCP designates gasoline and diesel supplies for use by emergency vehicles and generators.

4.3 NATURAL GAS

The primary natural gas supply chain consists of the extraction and processing of natural gas; the transportation of that gas via pipeline; and the underground storage or direct use of the gas for heating, fuel, electricity generation, or other uses. Natural gas can also be liquefied, reducing its volume by a factor of 600 and allowing for much easier distribution and storage. The process of creating Liquified Natural Gas (LNG) is very expensive; it accounts for only 2% of Oregon's natural gas consumption.[38]

Source: Department of Environmental Quality

4.3.1 Consumption

Natural gas is used for electricity generation, heating, cooking, powering vehicles, and other uses. Approximately one in three Oregonians rely on natural gas as the primary source for heating their homes—less than the national average of about half of residents.[39]

In 2009 Oregon consumed about 250 billion cubic feet of natural gas, or about 250 trillion BTUs. Of this amount, 44% was used to generate electricity. Most of the remainder was used directly by the residential, industrial, and commercial sectors, and about 3% was used for transportation.

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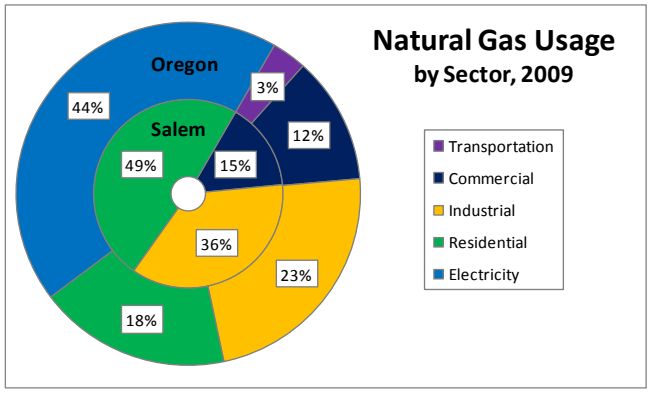
[37] Oregon Department of Energy, *Oregon State Energy Assurance Plan* (Salem: Oregon Department of Energy, 2011).
[38] Oregon Department of Energy, *Oregon State Energy Assurance Plan* (Salem: Oregon Department of Energy, 2011).
[39] U.S. Energy Information Administration, *State Energy Data System* (Washington, DC: U.S. Energy Information Administration, 2011).

In Salem, which has no natural gas power plants, the breakdown is significantly different. Almost half of the natural gas is used by residential customers, and the remainder is used by industrial and commercial customers. **Figure 4.5** shows the natural gas sector breakdown in Oregon and Salem.

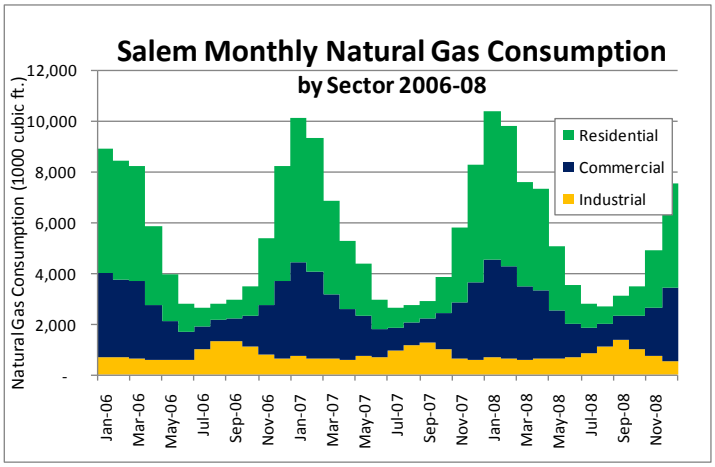
FIGURE 4.5



Northwest Natural

Natural gas usage is not homogeneous throughout the year. It fluctuates with the seasons, as demand (and thus price) rises during the cold winter months and falls in the summer. Industrial demand slightly offsets this fluctuation, since industrial customers are more likely to use natural gas in the summer when the price is low. **Figure 4.6** shows the monthly rate of natural gas consumption in Salem from 2006-2008, broken down by sector.

FIGURE 4.6



Source: U.S. Energy Information Association, Northwest NaturalSource: U.S. Energy Information Association,

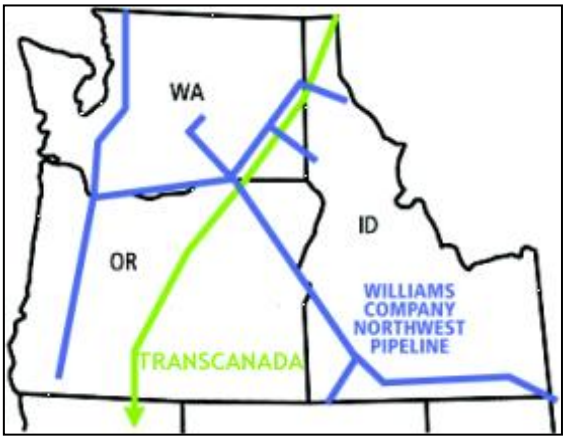
4.3.2 Supply and Distribution

Oregon produces no natural gas of its own and must import its entire supply from out-of-state. Oregon's natural gas is produced in British Columbia, Alberta, Wyoming, Colorado, and New Mexico, and is transmitted to Oregon via an interstate pipeline system.

Two major pipelines connect Oregon to gas-producing regions: The Williams Company Northwest Pipeline, which carries gas from British Columbia and the Rocky Mountain West, and the Gas Transmission Northwest Pipeline carries gas from Alberta. Oregon has a total of 1,823 miles of natural gas transmission pipeline.[40] Compression stations along the pipelines keep gas flowing, and local distribution companies transmit the gas from the main pipelines to end users via smaller distribution pipes. **Figure 4.7** shows the major natural gas transmission lines in Oregon.

[40] U.S. Energy Information Administration, *State Energy Data System* (Washington, DC: U.S. Energy Information Administration, 2011).

FIGURE 4.7: MAJOR NATURAL GAS TRANSMISSION LINES IN OREGON



Source: Oregon Energy Assurance Plan

Salem's natural gas arrives via the Williams Company Northwest Pipeline and is distributed by Northwest Natural. Northwest Natural serves about 80% of Oregon's retail customers, and owns an underground storage facility in Mist, Oregon (about 100 miles from Salem, in northwest Oregon). There is no major natural gas storage facility in or around Salem other than the transmission grid itself. The entire Northwest Natural system (pipelines, storage tanks, and LNG) contains, depending on the season, about 10 days' worth of natural gas supply, although the availability of this supply depends on the integrity of the distribution system.[41]

4.3.3 Vulnerabilities

Since Salem imports all of its natural gas and stores very little, it relies almost entirely on the Williams Company Northwest Pipeline branch running south from Portland to maintain a steady supply. A break in that pipeline would make Salem reliant on in-pipe gas storage (dependent on the magnitude and location of the break) and imports of LNG via the road network. The ability of these sources to meet demand in a lengthy disruption is uncertain, and the higher cost of LNG would pose an economic burden.

The severity of consequences of a local disruption in the natural gas supply would depend largely on the time of year, as Salem's natural gas consumption in the winter is about four times what it is in the summer. A larger-scale, state-wide or regional disruption in the natural gas system could potentially cause electrical disruptions in Salem, as natural gas power plants are a major source (40%) of Salem's electricity.

4.4 ELECTRICITY

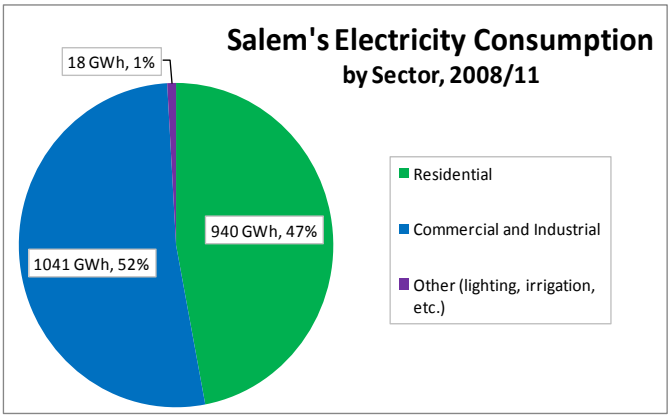
Because of its versatility, electricity is a vital source of power used by all sectors of the Oregon economy. Electrical generation consumes almost half of Oregon's energy, but since much of that energy is lost in the generation and transmission process, electricity only accounts for about 22% of energy consumption by end users.[42]

[41] Robbie Roberts, NW Natural, statement at LEAP resource group meeting, 13 April 2011.
[42] U.S. Energy Information Administration, *State Energy Data System* (Washington, DC: U.S. Energy Information Administration, 2011).

4.4.1 Consumption

Salem consumes about 2,000 gigawatt-hours (GWh) of electricity every year, or about 4.2% of Oregon's total electricity consumption. Almost half of Salem's electricity is used by residential customers, and most of the rest is used by commercial and industrial customers. About 1% of Salem's energy is used for outdoor lighting, irrigation, and other uses. **Figure 4.8** shows Salem's annual electricity consumption, broken down by end-use sector.

FIGURE 4.8:

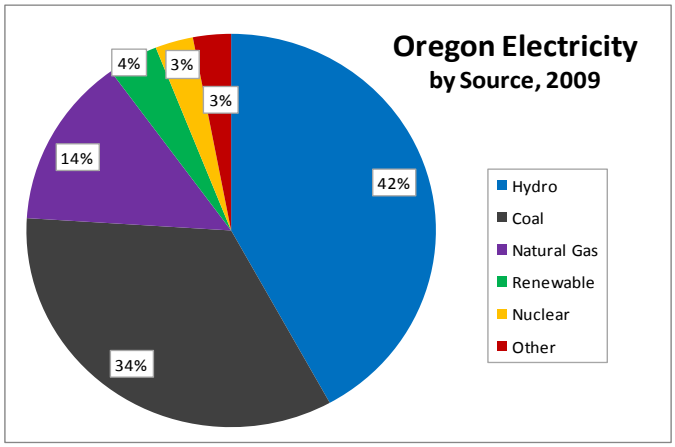


Source: Portland General Electric, Salem Electric

4.4.2 Supply and Distribution

Nationally, about 70% of electricity is produced by burning fossil fuels. In Oregon, with its vast hydroelectric capacity, only about 50% of electricity comes from fossil fuels – primarily coal and natural gas. Hydropower accounts for about 42% of Oregon's electrical generation (although this varies depending on hydroelectric conditions), and the remainder comes from nuclear, wind, and miscellaneous other sources such as burning wood. **Figure 4.9** shows the fuel source breakdown of electricity consumed in Oregon.

FIGURE 4.9:



Source: Energy Information Administration

Most of Oregon's hydropower comes from large dams on the Columbia and Snake Rivers; coal power comes from the Boardman Plant in Northeast Oregon and other plants in Utah, Wyoming, and Montana. There are natural gas plants located in the northeastern, northwestern, and southern parts of the state.[43]

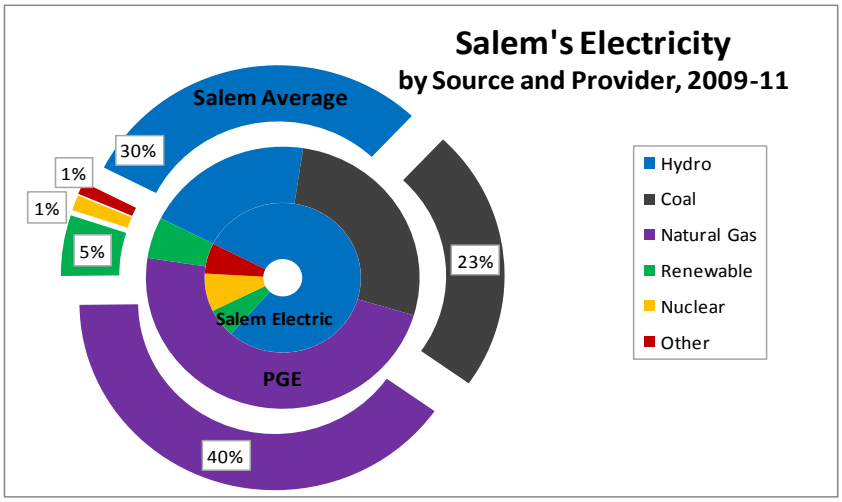
Wind energy fills a small but increasing portion of Oregon's energy demand, thanks in part to Renewable Portfolio Standard requirements. In particular, the Columbia Gorge

[43] Oregon Department of Energy, *Oregon State Energy Assurance Plan* (Salem: Oregon Department of Energy, 2011).

region of northeastern Oregon has seen significant wind development in the past decade, and more is planned. [44]

Electricity is transported through the state on a grid of transmission lines and substations. It is also transmitted between states on large transmission lines. The Western Interconnection or Pacific Intertie connects Oregon to British Columbia, Alberta, and Washington to the north and California and Mexico to the south. This system allows utilities in Oregon to buy or sell power to other states when Oregon's demand is higher or lower than in its neighbors'.[45]

FIGURE 4.10:



Source: Portland General Electric, Salem Electric

The residents and businesses of Salem receive electricity from two providers: Salem Electric and Portland General Electric (PGE).

Salem Electric is a consumer (referred to as "member")-owned electric cooperative that serves the Salem and Keizer area. Salem Electric's service area is primarily concentrated in West Salem. In 2009, Salem Electric billed over 18,500 accounts and sold 322.9 million kWh of electricity.[46] Much of the Oregon-based consumer-owned utility power, Salem Electric's power included, comes from the Bonneville Power Administration (BPA), a federal power-marketing agency.[47]

Portland General Electric (PGE) is the predominant electric power supplier of Salem. It is a vertically integrated electric utility engaged in the generation, purchase, transmission, distribution, and retail sale of electricity in the state of Oregon.[48] PGE's service accounts for 4,000 square miles of Oregon and includes 52 cities, of which Portland, Eugene, and Salem are the largest. PGE estimates that its service area population was 1.7 million in 2009, compromising about 43% of the state's population. [49] PGE produces and purchases electricity primarily from coal- and natural gas-driven plants, along with

[44] Oregon Department of Energy, *Oregon State Energy Assurance Plan* (Salem: Oregon Department of Energy, 2011).
[45] U.S. Energy Information Administration, *State Energy Data System* (Washington, DC: U.S. Energy Information Administration, 2011).
[46] Salem Electric. *2009 Annual Report*. 15 July 2011. http://salemelectric.com/universal/pdfs/annual_reports/2009_AnnualReport.pdf.
[47] Oregon Department of Energy. Rep. Web. 3 Feb. 2011. http://www.oregon.gov/ENERGY/CONS/docs/EnergyUseOR.pdf?ga=t.
[48] Portland General Electric Company, *2009 Annual Report*. 3 February 2011. http://www.portlandgeneral.com/AR2009/2009AR.pdf.
[49] Portland General Electric Company, *2009 Annual Report*. 3 February 2011. http://www.portlandgeneral.com/AR2009/2009AR.pdf.

hydroelectric power generated by dams on the Clackamas, Willamette, and Deschutes rivers.[50] PGE meets approximately 50% of its energy requirement with company-owned generation, purchasing the balance of its power from the wholesale market. [51]

Overall, slightly less than one-third of Salem's electricity comes from hydropower and slightly less than two-thirds comes from coal and natural gas. The remainder is mostly renewable generation such as wind power. **Figure 4.10** shows the fuel source breakdown for PGE, Salem Electric, and a weighted average for Salem as a whole.

4.4.3 Vulnerabilities

The electrical system is vulnerable to disruptions of the transmission grid, shortages in the supply of fuel sources, and shortfalls in production relative to demand. Within the community of Salem, minor localized grid disruptions are fairly common, and local utilities are adept at responding to them.

However, response to grid disruptions depends on the availability of other resources, such as fuel for repair vehicles and an unobstructed road network. If an emergency event were to cause a severe disruption to the electrical grid while also disrupting the systems that support that grid, the electrical system might be down for much longer than would otherwise be the case.

4.5 Conclusion

Key points from this energy profile include:

- Oregon imports 100 percent of its petroleum and natural gas, but generates most of its own electricity.
- Salem generates almost no electricity, and over half of its electricity supply is dependent on fossil fuels.
- Local generation and storage of electricity through on-site generators, solar panels, fuel cells, battery arrays, and other technologies can provide a way for individual facilities to diminish their vulnerability to electrical supply disruptions. Adoption of these technologies is far from universal; a widespread or long-term electrical outage would likely have severe consequences.
- The Puget Sound refineries provide more than 90 percent of Oregon's refined petroleum products, and it operates at about 95 percent capacity.
- About one-third of Oregonians residents use natural gas for heating, and Salem's natural gas supply is dependent a on a single pipeline.
- Salem depends on the road network for deliveries of petroleum products, and for deliveries of liquefied natural gas (LNG) if the natural gas network is disrupted. A petroleum pipeline travels through Salem but has no outlet there.

[50] Portland General Electric Company, *2009 Annual Report*. 3 February 2011. http://www.portlandgeneral.com/AR2009/2009AR.pdf.
[51] Portland General Electric Company, *2009 Annual Report*. 3 February 2011. http://www.portlandgeneral.com/AR2009/2009AR.pdf.

- Salem has in the range of 36 hours to 5 days-worth of petroleum-based fuel storage, most of it in the storage facilities of privately-owned businesses (e.g., filling stations).
- Salem has access to at most 10 days of natural gas supply if imports are cut off, but the actual availability would likely be much less depending on the time of year and where in the system disruptions occurred.

Salem's reliance on petroleum, natural gas, and electricity for everyday functions makes it vulnerable to energy interruptions. Knowing where Salem's energy comes from, how it is transported, and how much of each energy source is used regularly can provide better information for residents, emergency operations staff, and policy makers to help mitigate energy supply disruptions.

PART II: SALEM CITY GOVERNMENT ENERGY PROFILE

4.6 OVERVIEW

Part II of this Chapter provides a profile of the Salem Government Facilities and provides details on energy supply and distribution, as well as consumption by City of Salem-owned "Critical Assets". As noted in Chapter 2 of this LEAP report, the City of Salem critical assets include both critical facilities and critical infrastructure. Additionally, this section expands upon the previous section by detailing how energy flows into the City of Salem are distributed and consumed by city owned and/or operated facilities and infrastructure.

This section summarizes the energy use of the City of Salem's critical facilities (i.e. fire stations) and infrastructure (i.e. sewer pumps). This energy use summary provides a baseline of energy supply and distribution, and energy consumption patterns that informs our final recommendations.

Consistent with Part I of this chapter, Part II is organized by energy type (Petroleum, Natural Gas and Electricity) and for the energy type the information is organized by (a) supply and distribution; and (b) consumption. Vulnerabilities are discussed in Section 4.10.

It is important to keep in mind the overall discussion from Part I and its conclusions immediately above.

4.7 PETROLEUM

City of Salem government facilities, vehicles and equipment rely on petroleum to conduct necessary functions. For this report, petroleum fuel is categorized as unleaded fuel, diesel fuel, and propane. The data that informs this section was collected through stakeholder interviews with staff and personnel well acquainted with these issues, resource group meetings, survey information, site visits, and data provided by Salem Fleet.

4.7.1 Supply and Distribution

Salem Fleet is the department for the City of Salem that is responsible for ordering the petroleum supply and distributing the fuel supply to the City of Salem departments and facilities. Salem Fleet receives fuel that travels through the Port of Portland and is delivered by fuel tanker trucks from Portland to Salem. Salem Fleet supplies City of Salem facilities, equipment and vehicles by tanker fuel trucks that directly refuel vehicles, equipment and backup generators at facilities that have a generator, and fuel storage tanks.

Salem Fleet has three fuel storage tanks located at the Fleet Shops. Salem Fleet has two 20,000-gallon underground fuel storage tanks: one that stores diesel fuel and one that stores unleaded gasoline, located at the Salem Fleet Shops. These fuel storage tanks are typically depleted by two months of regular City of Salem government facility day-to-day operations. Salem Fleet refuels the fuel storage tank when it is about half-full, or approximately refueling the tank with 11,000 gallons of fuel once a month. Salem Fleet

also has a 2,000-gallon propane storage tank and dispenser located at the Salem Fleet Shops.

Additionally, the City of Salem has a 1,000-gallon underground diesel fuel storage tank located at Fire Station #1. Salem's wastewater treatment plant, located to the north of Willow Lake, also has two fuel storage tanks: a 5,000-gallon tank for diesel, and a 1,000-gallon tank for unleaded fuel[52].

Salem Fleet also has an agreement with Pacific Pride gas stations to provide additional petroleum supply to vehicles and equipment. In order for a City of Salem Department to use a Pacific Pride gas station for fueling needs, the Department must contact Salem Fleet to gain access to Pacific Pride gas stations.

4.7.2 Consumption

Table 4.2 summarizes the daily petroleum use for the City of Salem critical facilities and departments and also indicates the consumption of each type of petroleum fuel.[53] The critical facilities that are listed in the tables do not represent one facility, but rather multiple facilities that make up one City of Salem department.[54] Non-critical uses include vehicles that are used by Salem departments that are not deemed as critical facilities for travel uses.

TABLE 4. 2: CITY OF SALEM GOVERNMENT FACILITIES/DEPARTMENTAL DAILY PETROLEUM CONSUMPTION IN GALLONS, 2009-2010

Facility/Department	Unleaded	Diesel	Propane	Daily Usage*	Percent of Total
Police	510	4	0	515	*29.80%*
Fire	28	166	0	202	*11.70%*
IT	6	0	0	6	*0.00%*
Public Works	434	446	2	905	*52.30%*
Fleet Services	16	2	1	20	*0.02%*
Other Facilities /Functions (Non-Critical)	78	3	0	1,028	*6.18%*
TOTAL	**1,072**	**621**	**3**	**1,729**	***100%***

Source: Salem Fleet Services & Public Works, 2009-2010

*Additional gallons included in Daily Usage reflect the use of Bio-Diesel per day.

[52] Data provided by Donald Thomson, Salem Fleet/Warehouse Superintendent, and Barry Buchanan, Senior

[53] The consumption information provided by Salem Fleet is taken from the 2009-2010 fuel and equipment usage report that consists of the site of the petroleum use, gallons of fuel used, the fuel type, among other information that is not relevant to this report.

[54] For example, Salem Fire has multiple facilities, equipment, and vehicles that require petroleum fuel. Instead of listing each fire station, fire vehicles and equipment, the information is combined to represent a total usage of Salem Fire department.

Table 4.2 further shows that the Salem Police Department and Salem Public Works use the most fuel of Salem's Facilities and Infrastructure petroleum demands. The use of petroleum fuels is typically the result of operations requiring vehicles such as squad cars and heavy equipment such as maintenance vehicles, respectively.

A. Salem Police

Salem Police consumes 29.8% of the total petroleum used by City of Salem government facilities. Salem Police use nearly 129,000 gallons of petroleum fuel annually, which is the same as refueling a mid-size sedan[55] about 22 times per day. The majority of fuel that Salem Police consume is unleaded fuel, which is mainly due to the need to keep Salem's police vehicles running for essential duties. Additionally, on an average day the police fleet is at 60-70% operational,[56] but in an emergency the fleet would be at 100%. As the number of police vehicles in use increases, the need for unleaded fuel intensifies.

B. Public Works

The Public Works department consumes over half of the City's total, averaging slightly more diesel than petroleum. Public Works spanning over many forms of services from Transportation, Parks, as well as "Wet Utilities," it logically equates to the use of heavy machinery and maintenance vehicles which run on diesel fuel, as well as small vehicles to maintain parks and standard road maintenance which run on unleaded fuel. Operations and maintenance of Transportation networks accounts for nearly one-third of daily petroleum use. These services are demanded in emergency situations to assure road clearance for emergency vehicles, and may become particularly critical in foul weather events to remove road debris.

C. Salem Fire

Salem Fire trucks run primarily on diesel fuel, contributing to high consumption rate of diesel, whereas some of their support vehicles do run on unleaded fuel. Salem Fire on a daily basis consumes approximately 166 gallons of diesel fuel, which is the same a refueling a large diesel truck[57] about 10 times every day. As mentioned previously, Salem Fire Station #1 has a 1,000-gallon underground diesel fuel tank that provides some of the diesel fuel needed for operations. Salem Fleet tanker trucks refuel both the storage tank and the fire vehicles and equipment directly.

4.8 Natural Gas

The City of Salem government critical facilities rely on natural gas for space heating, water heating, and in a few cases for cooking appliances. While these functions may not be critical in an energy disruption, they are important functions to keep facilities comfortable and operations running smoothly and may increase in importance as the length of any energy disruption increases. Space heating is obviously more important during winter months, and may become a major constraint on vital aspects of critical

[55] Standard Sedan with a 16-gallon fuel tank capacity.
[56] Data from resource group meeting minutes. Salem Police representative
[57] Large Diesel Truck with a 40-gallon fuel tank capacity.

functions and the health/safety of staff of any given facility if temperatures are extremely low. Also, vital equipment may need to be reviewed for temperature sensitivities – are their temperatures above or below which operational failures may be expected?

The information in this section is culled from Part I of this Chapter as well as additional data provided by Northwest Natural and Salem Public Works.

4.8.1 Supply and Distribution

Northwest Natural is the sole natural gas distributor for the City of Salem. Northwest Natural provides natural gas for all of the City of Salem facilities. As noted in Part I, the two main forms of natural gas are natural gas and liquefied natural gas (LNG); the consumption data below includes both types of natural gas in the calculations.

4.8.2 Consumption

Table 4.3 summarizes the annual and daily usage of natural gas for each Salem facility/department. As in the petroleum section above, the facilities singled out in this table are only the Salem government critical facilities; all other non-critical functions are presented together in the "other" category.

TABLE 4. 3: CITY OF SALEM GOVERNMENT FACILITIES/DEPARTMENTAL NATURAL GAS CONSUMPTION IN CUBIC FEET, 2009-2010

Facility/Department	Annual Usage	Daily Usage	Percent of Total
Police	1,463,651	5,855	*7%*
Fire	2,301,944	9,208	*10%*
IT	771,400	3,086	*3%*
Public Works	3,426,300	13,705	*15%*
Fleet Services	1,789,240	7,157	*8%*
Wastewater Treatment	6,626,000	26,504	*30%*
Other Facilities /Functions (Non-Critical)	5,949,965	23,800	*27%*
TOTAL	**22,328,500**	**89,314**	***100%***

Source: Northwest Natural & Salem Public Works, 2009-2010

Table 4.3 indicates that the Salem's wastewater treatment plant located at Willow Lake uses approximately 30% of the natural gas of all Salem government facilities, making it the largest consumer of natural gas. Willow Lake Waste Water Treatment Facility uses roughly 26,504 cubic feet of natural gas daily, though it supplements this number with recovered methane.

While many cities use natural gas generators as their backup power sources, the City of Salem currently does not use natural gas for any emergency power generation. Similar to 35% or Oregon's residents, natural gas is primarily used for heating of City-owned buildings.[58]

[58] U.S. Department of Energy, Energy Efficiency & Renewable Energy State Activities & Partnerships. "Energy Consumption in Oregon Homes" 5 August 2011. http://apps1.eere.energy.gov/states/residential.cfm/state=OR

Salem's Fire Stations use natural gas for heating, as well as relying on natural gas for cooking appliances when the fire fighters are on duty. Although important for the long-term operation of these facilities, the heating and cooking functions of natural gas would likely not be critical during a short emergency event. As noted above, space heating is obviously more important during winter months, and may become a major constraint on vital aspects of critical functions and the health/safety of staff of any given facility if temperatures are extremely low. Also, vital equipment may need to be reviewed for temperature sensitivities for continued optimal operation.

4.9 ELECTRICITY

Electricity is the most crucial energy form used by the City of Salem, enabling the City's critical facilities to function on a daily basis. Communications, lighting, heating, cooling, data storage, and many of the fine-grained operations of the City rely on electrical power.

4.9.1 Supply and Distribution

Portland General Electric (PGE) provides electricity to 75% of the City of Salem's government facilities. PGE provides service to City of Salem facilities that are located in Central and East Salem. Salem Electric provides the remaining 25% of power to City-owned facilities, all of which are located in West Salem. Both Salem Electric and PGE provide electricity to City-owned buildings, street lighting, and critical infrastructure.

The distribution of electricity within the City of Salem follows the traditional grid pattern of transmission and distribution lines. Electrical transmitters located throughout Salem provide the electricity to Salem government facilities.[59]

4.9.2 Consumption

Table 4.4 summarizes the electrical usage for Salem government facilities.[60] The data takes into account not only City of Salem government facilities, but also the functions of Salem departments. For example, Salem Public Works is responsible for sewer pumps and street lighting in Salem; however, the data table separates sewer pumps and street lighting from the other Salem Public Works electrical usage. Sewer pumps and street lighting are tracked as individual functions because of the large volumes of electricity utilized.

[59] However, the location of the electrical transmitters is information that the electrical companies keep confidential and therefore is not included in this report.

[60] The data from each source is based on PGE and Salem Electric 2010-2011 usage information.

TABLE 4. 4: CITY OF SALEM GOVERNMENT FACILITIES/DEPARTMENTAL ELECTRICITY CONSUMPTION IN KWH, 2010-2011

Facility/Department	Annual Usage	Daily Usage	*Percent of Total*
Police (Including City Hall, co-located)	5,126,400	20,506	*15%*
Fire	757,504	3,030	*2%*
IT	1,042,200	2,855	*3%*
Public Works	3,554,629	14,219	*10%*
EOC/Willamette Valley Communications Center	315,800	865	*1%*
Fleet Services	58,309	160	*0%*
Water Treatment Plant	7,735,539	21,193	*22%*
Street Lighting & Traffic Signals	11,131,212	23,477	*32%*
Pumps	4,708,638	12,900	*13%*
Other Facilities/Functions (Non-Critical)	717,079	2,868	*2%*
Total Daily Usage	**35,147,309**	**100,745**	***100%***

The Public Works department provides many of the services essential to continuation of functionality for many other facilities. Coordinating service and maintenance of wet utilities, transportation services, and remaining Public Works facilities together consumes nearly three-quarters of Salem's municipal electricity consumption. Unlike other facilities and services operating on a typical business schedule, infrastructure and its coordination continues to work around the clock. Of particular interest is the primary use of grid electricity: street lighting. Traffic lights, streetlights, and park lights make up approximately 32% of all of the electrical use by Salem government facilities.

Salem's wastewater treatment plant at Willow Lake uses slightly less electricity than street lighting, at approximately 22%, but maintains service year-round. The Willow Lake Waste Water Treatment plant is able defray electricity consumption by harvesting methane and burning it to generate electricity. Recovered gas provides nearly one-third of the wastewater facility's electricity.[61]

Salem City Hall (Civic Center), which provides space for the Salem Police Department, administrative offices, and other departments, uses about 15% of the total electricity use of all Salem government facilities. Annually, City Hall uses 5 million KWH of electricity or around 20,000 KWH per day. Each day the City Hall electrical usage is the equivalent of the electricity used by about average 640 homes.[62]

[61] An upgrade of the co-generation engine can increase the electrical generation to 1.2 MW (instead of 600 KWH existing). The plant will have the ability to "black start" with the upgraded co-generation engine.

[62] Based on EIA 2007 estimates of 31.2 kWh per day.

4.10 VULNERABILITIES

Energy use in the City of Salem government facilities is fairly typical for an American city. Petroleum, natural gas, and electricity are the three main forms of energy supplied, distributed, and consumed in the City of Salem.

For each of these energy sources, there are key findings relating to vulnerabilities.

4.10.1 Petroleum

Petroleum use for Salem government facilities is handled by of Salem Fleet. Salem Fleet has the entire responsibility of petroleum supply and distribution for the City of Salem facilities until such time that outside or higher-level resources can be secured. This arrangement has a key potential weakness during certain types of emergencies. If, for any reason, Salem Fleet is unable to refuel generators and/or emergency vehicles for prolonged periods of time, it may leave essential emergency response and coordination departments, such as Salem Police and Salem Fire or the EOC, without sufficient fuel to perform their assigned critical functions.

Additionally, some high-volume users of petroleum, such as Salem Police, do not have a fuel storage tank to meet its needs. On-site storage for high-volume users throughout the City of Salem can provide a greater level of security for essential functions, should refueling be unavailable in an energy emergency.

4.10.2 Natural Gas

Natural Gas use in Salem government facilities is mainly for cooling and heating functions. These functions may not be the most critical in the case of an energy emergency. Space heating, however, becomes more important during winter months, and may become a major constraint on vital aspects of critical functions and the health/safety of staff of any given facility if temperatures are extremely low. Also, vital equipment may need to be reviewed for temperature sensitivities for continued optimal operation. In addition, it is important for the natural gas connections to be easily disconnected to prevent fire and other disasters in certain situations.

4.10.3 Electricity

High electricity use in the City of Salem is primarily attributed to the maintenance and function of City infrastructure including, but not limited to: wet utilities and street lighting. Electricity, though not used to such scale, is vital to many other City functions; communications, computers, space heating, cooling, cooking, and other resources may be critical to operations for many of Salem's facilities. During disruptions of electrical power, backup generation capacity is crucial to Salem's ability to cope with and mitigate emergency events.

ATTACHMENT 4.1: CITY OF SALEM ENERGY CONSUMPTION DATA FOR FISCAL YEAR 2009-10

This chart represents petroleum, propane, natural gas, and electricity consumption of City of Salem departments for the 2009-2010 fiscal year. This chart was supplied by Barry Buchanan on 12/12/2011.

CHAPTER 5: RISK ASSESSMENT

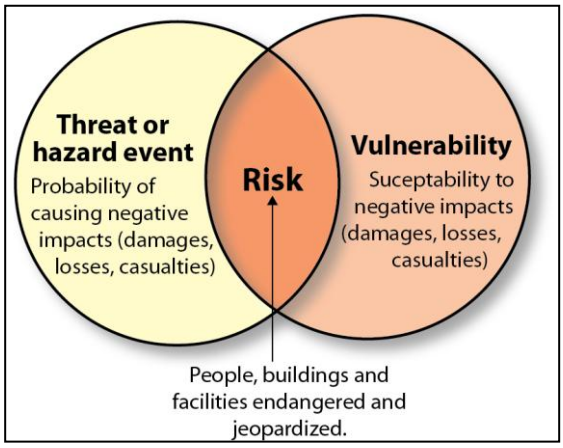
5.1 INTRODUCTION

5.1.1 Overview

The purpose of the Risk Assessment is to understand the causes, possibilities and ramifications of energy disruptions in the City of Salem.

Risk can generally be defined as the jeopardy or danger to which people and the built environment are exposed by hazards or threats. Risk is the potential for damages, losses and casualties arising from the negative impact of hazards on the built environment. Risk is generally expressed in terms of: (1) dollars (estimates of potential damages and other economic losses); and (2) casualties (numbers of deaths and injuries).

FIGURE 5.1 RISK: THE COMBINATION OF THREAT/HAZARD EVENT AND VULNERABILITY



For the purposes of this Local Energy Assurance Plan, the focus is on City of Salem high priority ("value") critical assets (facilities, infrastructure) and the risks that can create emergency situations by disrupting normal energy flows (e.g., electricity, diesel fuel, gasoline, natural gas, propane). Risk for this study is expressed in terms of loss of energy to high priority critical facilities and critical infrastructure with an emphasis on the duration of time for the disruption of energy that any given critical asset would suffer, thus impairing or causing loss of critical function.

Generally speaking, the **level of risk** at a given location, building, facility or infrastructure depends on the combination of **threat** or **hazard event** and **vulnerability** as shown in **Figure 5.1**.

5.1.2 Threat or Hazard Event

Threat or **Hazard Event** refers to natural or human-caused events that may cause damages, losses or casualties. Examples of threats or hazard events include floods, winter storms, landslides, earthquakes, hazardous material spills, human violence, and terrorism. Hazards are characterized by their frequency and severity as well as by the duration, speed of onset and the geographic area affected. Each hazard is characterized differently, with appropriate parameters for the specific hazard. For example, floods may be characterized by the areas inundated, frequency of flooding, along with flood depth and flood velocity. Winter storms may be characterized by the amount of rainfall in a 24-hour period, or by wind velocity, temperature changes, and amount of snow, or ice associated with a storm. Earthquakes may be characterized by the severity and duration of ground motions, and so on.

A hazard event, by itself, *may not* result in any negative impacts on a community. For example, a flood-prone five-acre parcel may typically experience several floods per year, even up to depths of several feet of water typically expected in say a 50-year flood event. The high frequency and severe nature of the flooding would lead one to conclude that flooding of this parcel is a hazard event or threat of high severity or magnitude. However, if the parcel is a wetland, with no structures or infrastructure, then there is no vulnerability. Because there is no vulnerability, clearly no people or any aspects of the built environment are endangered or jeopardized, and thus there is no risk. In this example, the very frequent and deep flooding (i.e., the high hazard) may be beneficial environmentally by providing wildlife habitat and recreational opportunities.

Threat or hazard events do not produce risk to people and property, unless there is vulnerable inventory exposed to the hazard. Risk to people, buildings and/or infrastructure results only when hazards are combined with **vulnerability**.

5.1.3 Vulnerability

Vulnerability is the degree to which individuals, the community as a whole, the built environment, systems, other assets and resources, and cultural, economic, and social activity are susceptible to harm, degradation, or destruction. Vulnerability is specific to a particular location, which may be subject to one or more threats or hazard events.

Vulnerability primarily involves the "inventory" of people and the built environment in harm's way. Inventory can be characterized by the number, size, type, use, and occupancy of buildings as well as by the infrastructure present in any given specific location. Infrastructure includes bridges, roads and other transportation systems, utilities (e.g., potable water, wastewater, natural gas, and electric power), telecommunications systems, and so on.

The various components of a community's "inventory" vary greatly in importance to the vitality and normal functioning of that community. Some types of facilities and infrastructure, **"critical facilities"** and **"critical infrastructure,"** are especially important to a community, particularly during emergency situations. Examples of critical facilities include police and fire stations, hospitals, 911 centers, emergency operations centers, and emergency shelters. Critical infrastructure include important utility links, utility lines, and life lines, that are essential in providing service to large numbers of people such as a potable water, waste water sanitation, an electricity, natural gas, and so on. (See Chapter 2 for further details on Critical Facilities and Critical Infrastructure.)

Traditionally risk assessment focuses on not only "inventory" (persons present at a given site and the quantity and value of buildings or infrastructure present), but also by its vulnerability to each hazard under evaluation. For example, a given facility or infrastructure may or may not be particularly vulnerable to flood damages or earthquake damages, depending on its location as well as the details of its design and construction, but could be vulnerable to landslides and wildland/urban interface fires.

Depending on the hazard, different measures of the vulnerability of buildings and infrastructure are often used.

For purposes of this Local Energy Assurance Plan, the focus will be on **energy vulnerability**, which is the likelihood or the degree to which the essential energy supply of any given critical community asset – critical facility or infrastructure -- will be disrupted or exhausted during an emergency event.

5.1.4 Risk

Risk is the potential for future damages, losses or casualties. An emergency event happens when a hazard event is combined with vulnerable inventory (that is when a hazard event strikes vulnerable inventory exposed to the hazard). The highest risk in a community occurs in high hazard areas (frequent and/or severe hazard events) with large inventories of vulnerable "high value" buildings, especially critical infrastructure or critical facilities.

However, high risk can also occur with only a moderately high hazard, if there is a large inventory of highly vulnerable "high value" inventory exposed to the hazard. For example, seismic hazard is lower in Oregon than in the seismically active areas of California. However, for some buildings, seismic risk in Oregon may be comparable to or even higher than seismic risk in California, because some of the building inventory in Oregon is much more vulnerable to earthquake damages. Conversely, a high hazard area can have relatively low risk if the inventory is resistant to damages (e.g., elevated to protect against flooding or strengthened to minimize earthquake damages).

As noted previously, risk for purposes of this Local Energy Assurance Plan will be expressed in terms of loss of energy to high priority ("value") critical facilities and critical infrastructure with an emphasis on the duration of time for the disruption of energy that any given critical community asset would suffer, thus impairing or causing loss of critical function.

5.2 Threat or Hazard Assessment

5.2.1 Background

The City of Salem has taken steps to prepare for emergency threats and hazards through a series of plans, spanning emergency management and natural hazard mitigation.

a. 2006 Salem Emergency Management Plan: The 2006 Salem Emergency Management Plan (SEMP) is an all hazards plan. As such it adopts the definition of an emergency found in Oregon Statues regarding Emergency Management (ORS 401.025):

An Emergency includes any manmade or natural event or circumstance causing or threatening loss of life, injury to person, environment or property, human suffering or financial loss, and includes, but is not limited to, fires, explosion, flood, severe weather, drought, earthquake, volcanic activity, spill or release of oil or hazardous material as defined in ORS 466.025, contamination, utility or transportation emergencies, disease, blight, infestation, crisis influx of migrants unmanageable by the county, civil disturbance, riot, sabotage, or war. For the purpose of this document, the word "emergency" will be used to mean either emergency or disaster exceeding the capabilities of local resources. (2006 SEMP, page 1)

b. 2008 Salem Natural Hazards Mitigation: Plan Furthermore, the City of Salem has a Natural Hazards Mitigation Plan, first written in 2003 and updated in 2008. This 2008 mitigation plan (pages 28-29) identified and profiled the previous occurrences, and future probability of natural hazards that could impact Salem. The natural hazards addressed in this 2008 assessment include:

- Drought
- Earthquake
- Flood
- Hazardous Materials
- Landslide
- Severe Wind & Ice Storms
- Urban Wildland Interface Fires
- Volcanic Eruptions

During the 2003 plan-development process, the Technical Advisory Committee (TAC) that created the document ranked all seven primary hazards in terms of overall vulnerability and then assigned a weighted vulnerability (low, medium, or high) to each of the hazards. In the 2008 Plan update, the Committee reviewed and updated the 2003 TAC rankings with additional information provided by the Oregon Partnership for Disaster Resilience.

Probability scores address the likelihood of a future major emergency within a specific period of time:

- **High [3]** = One incident likely within a 10 to 35 year period.
- **Moderate [2]** = One incident likely within a 35 to 75 year period.
- **Low [1]** = One incident likely within a 75 to 100 year period.

The **vulnerability scores** address the percentage of population or regional assets likely to be affected by a major emergency:

- **High [3]** = More than 10% affected
- **Moderate [2]** = 1-10% affected
- **Low [1]** = Less than 1% affected

The Committee members based their scores on historical information, experience, and probability and vulnerability scores found in the Marion and Polk County Natural Hazards Mitigation Plans. Once Committee members identified the probability and vulnerability scores, the scores were assigned a numerical value, with a high score having a value of 3, a moderate score a value of 2, and a low score a value of 1. The probability and vulnerability scores were multiplied together to determine the natural hazard ranking: the higher the score, the higher the hazard priority. As determined by the committee working on the 2008 update, floods, earthquakes, and severe wind and ice storms were rated the primary concern to the City (see Table 5.1). Landslides and hazardous materials were ranked as a secondary concern, and wildfire and drought were ranked as a lesser concern. Lastly, volcanic eruptions were ranked as a very low concern for the City of Salem.

TABLE 5.1: 2008 CITY OF SALEM HAZARD PROBABILITY AND VULNERABILITY ASSESSMENTS

Hazard	Probability	Vulnerability	Hazard Ranking
Flood	High	High	9
Severe Wind & Ice Storms	High	High	9
Earthquake	High	High	9
Landslide	High	Moderate	6
Hazardous Materials Incidents	Moderate	High	6
Urban-Wildland Interface Fires	Moderate	Moderate	4
Drought	Moderate	Moderate	4
Volcanic Eruptions	Moderate	Low	2

Source: City of Salem 2008 Natural Hazards Mitigation Plan, page 11.

5.2.2 PTI Guidelines[63] for Assessment of the Threat Environment

The PTI guidelines for local energy assurance planning indicate that "knowing what may cause a disruption can increase defensive steps to enhance energy assurance as well as create a more efficient response, continuity and recovery strategies." The PTI guidelines, offer the following categories of threats for jurisdictions to consider in their local energy assurance planning efforts:

- *Deliberate* threats or attacks caused by people (e.g., terrorists, criminals, hackers, delinquents, employees);
- *Natural* threats caused by nature (e.g., hurricanes, tornadoes, floods, wildfires, earthquakes);
- *Accidental* threats caused by technological failure (e.g., pipeline rupture, levee breaches, chemical spills, nuclear, or biological contamination); and
- *Systemic* threats caused by the physical inability of energy delivery systems to meet demand.

[63] U.S. Department of Energy, the Public Technology Institute: Local Government Energy Assurance Guidelines (2009), page 42.

The PTI Guidelines also note that existing state priorities and rules for utility outages and restoration, and/or a critical user list in a state petroleum set-aside plan may modify the impacts of energy supply disruptions on local jurisdictions. Such rules and plans may lessen or magnify supply disruptions in the City of Salem, and need to be examined.

5.2.3 City of Salem Classification of Threats

In keeping with Salem's all hazard approach to emergency management planning and response, this risk assessment takes into account a comprehensive list of potential threats or hazard events (see Table A5.1 attached at the end of this chapter). While this list of threats is intended to be comprehensive in terms of covering the possible types of threats and hazard events, it makes no pretense of being an exhaustive listing of the multitude and variety of threats and hazard events that any community could face.

For purposes of this for local energy assurance planning effort, these many types of threats are categorized into three main groups:

1. **Natural Hazards:** including the near-stand-alone subcategory of Public Health Emergencies (e.g., Epidemics).
2. **Technological System Failures (Accidental).**
3. **Intentional Human Attacks:** including the two subcategories of **Human Violence** and **Terrorism** (classification based on degree or scope of deliberate violence).

5.3 CITY OF SALEM LEAP RISK ASSESSMENT TOOL

5.3.1 Overview

Given the above local energy assurance planning classification of threats or hazard events, and the priorities of Critical Facilities and Critical Infrastructure established in Chapter 2, the methodology presented in Table 5.2 can be used to conduct a site by site energy risk assessment of the high priority critical facilities and infrastructure in Salem.

While it is important to understand the threat from each hazard that could impact any given critical facility or critical infrastructure element (e.g., 50-year flood, 6.5 magnitude earth quake, terrorist bomb), for purposes of this Local Energy Assurance Plan the key factor is the potential loss of energy flow to the critical facility or critical infrastructure. The major concerns are thus disruptions to the normal supplies of energy (chiefly electricity, natural gas, vehicle fuels, and propane) to the high priority critical assets.

5.3.2 Components and Methodology

1. **Critical Facilities and Infrastructure** (Column 1): Chapter 2 of this LEAP Report and its associated technical appendix explain and present the rationale for the lists of Critical Facilities and Critical Infrastructure used in this study.

2. **Priority Ranking** (Column 2): Chapter 2 of this LEAP Report and its associated technical appendix also explain and present the rationale for the ranking of the Critical Facilities and Critical Infrastructure used in this study. [1st Priority CF/CI = 4; 2nd Priority CF/CI = 3; 3rd Priority CF/CI = 2; 4th Priority CF/CI = 1.]

3. **Threats from Natural Hazards** (Column 3): To determine hazard threat, the matrix first uses City GIS data to determine if a given critical asset is "in" or "out" of a given hazard area (e.g., mapped flood area, mapped wildland/urban interface area, soils susceptible to liquefaction during an earthquake). Assets that are "in" receive a score of one; assets that are "out" receive a score of zero. As not all hazards will impact Salem equally, this matrix utilizes Hazard Rankings from the City of Salem 2008 Natural Hazards Mitigation Plan in Table 5.1.[64]

   Multiplying the hazard ranking by the in/out score, the matrix establishes a composite threat score for each site or critical asset. The score is presented on a scale of 0 to 9 for any given Hazard, with "0" indicating no threat (e.g., asset is not in the threat area), "1" indicating the lowest degree and "9" representing the highest degree of negative impacts potentially occurring as a result of the hazard event.

4. **Vulnerability** (Column 4): Vulnerability of the critical facilities and critical infrastructure is a composite weighting factor that takes into account a variety of factors that are of importance for the given critical facility, infrastructure element or system. Personnel who are very familiar with an asset and its history should be intimately involved in formulating its vulnerability weighting factor.

   a. **Attributes of Each Critical Asset:** The attributes used will vary for each critical asset. This could include the age, size, type of a structure as well as its overall current condition or "health," and the number of employees who work in the structure. It could include the age and type of materials of a potable water line or sanitary sewer. The assessment of both facilities and infrastructure could include their replacement value, or redundancies built into the overall system.

   b. **Technological System Failures (Accidental):** Threat of accidental technological system failures are included in the calculation of vulnerability because of their essential differences with natural hazards included above in "threat." A detailed knowledge of a given critical asset's technical elements, its history, and even engineering studies and assessments can be used to generate predictions about many types of system failures.

[64] Note that Hazardous Material (HAZMAT) incidents are not a "natural hazard," but are included here because of their inclusion in the 2008 Natural Hazards Mitigation Plan.

c. **Intentional Human Attacks (Human Violence / Terrorism):** The threat of human attacks on critical assets and/or their personnel also have essential differences with the natural hazards included above in "threat." It is crucial that personnel who are very familiar with an asset, its history and importance to the community, as well as professionals with expertise dealing with the human violence/terrorism work together to characterize and formulate this component of the vulnerability weighting factor.

5. **Risk Score** (Column 5): The Risk Score for any asset is a multiplication of the Priority (Column 2), Natural Hazard Threat (Column 3) and Vulnerability (Column 4) [P x NH x V]. For the LEAP study this is essentially an indicator of the risk for loss of energy to a critical asset.

6. **Sample Matrix Scores:** Please note that Table 5.2 contains ***sample*** Risk Scores in column 5 for illustration purposes based on data collected for this study. However, City staff will need to use their in depth knowledge of the City's Critical assets and the above and below noted methodology to arrive at the Vulnerability Factor for each critical asset and determine the Threat Score based on this study's GIS data base to calculate actual Risk Scores. This may involve further study by City staff of their assets and staff work sessions to make sure all relevant factors are included and accurately taken into account.

TABLE 5.2: SAMPLE LEAP RISK ASSESSMENT TOOL

1	2	3										4	5
Facility Name	Priority Ranking • 1st = 4 • 2nd = 3 • 3rd = 2 • 4th = 1	Natural Hazard Threats (GIS)										Vulnerability Factor - TBD • Physical Attributes • Human • Technical • Other	Risk Score Total = P*NH *V
		Flood (100) [HR=9]	Flood (500) [HR=9]	Wildfire (WUI) [HR=4]	Landslide [HR=6]	Earthquake [HR=9]	Earthquake (RVA	Volcano [HR=2]	Severe weather [HR=9]	Hazardous Mat. [HR=6]	Average Score		
City Shop #3 Fleet Services Office	1st	9	9	0	0	9	?	2	9	6	4.88	7	34.16
City Fire Station 6	1st	0	9	0	0	9	1	2	9	6	4.00	6	24
City Fire Station 4	1st	0	0	0	0	9	2	2	9	6	3.11	4	12.44
Willamette Valley Communication Center / EOC	1st	0	0	0	0	9	2	2	9	6	3.11	4	12.44
City IT Department	1st	9	9	0	0	9	?	2	9	6	4.88	5	24.4

Note: This table contains *sample* Risk Scores in column 5 for illustration purposes. These sample scores are based on actual data collected for this study

5.3.3 Calculating the Vulnerability Weighting Factor (Column 4 in Table 5.2)

As noted above, the "Vulnerability" of critical facilities and critical infrastructure is a composite weighting factor, which should be made by personnel who are very familiar with a given asset and its history. Many factors contribute to the calculation of this rating, including: physical attributes and overall "health" of the critical asset, its susceptibility to the threats of accidental technological system failures and intentional human attacks or terrorism. The calculation of the rating is more than a simple adding up of a list of weaknesses and strengths and then multiplying by priority ranking and average natural hazard ranking (P x NH x V). This is an opportunity for those who know well a given asset to emphasize factors that they know "trump" other considerations. For example, previous mitigation measures may be so effective that an overall Vulnerability rating should be "bumped down" a level or so. On the other hand, say with City Hall for example, the weaknesses of the structure to seismic events may well warrant "bumping up" the overall Vulnerability rating by one or even several levels. In all cases, the information and reasoning contributing to a vulnerability rating should be documented for future reference. The ratings below in Table 5.3 are intentionally set on a sliding scale of 1-10 to better represent the nuances associated with many factors that can be taken into account.

TABLE 5.3: VULNERABILITY RATING (Adapted from FEMA 452)

Rating	Numerical Score	Description of Findings and Factors that Contribute to the Rating
Very High	10	Very High: One or more major weaknesses have been identified that make the asset extremely susceptible to hazard or threat. The "building"* lacks redundancies/physical protection and the entire "building" would be only functional again after a very long period of time after an incident.
High	8-9	High: One or more major weaknesses have been identified that make the asset highly susceptible to a hazard or threat. The "building" has poor redundancies/physical protection and most parts of the "building" would be only functional again after a long period of time after an incident.
Medium High	7	Medium High: An important weakness has been identified that makes the asset very susceptible to a hazard or threat. The "building" has inadequate redundancies/physical protection and most critical functions would be only operational again after a long period of time after an incident.
Medium	5-6	Medium: A weakness has been identified that makes the asset fairly susceptible to a hazard or threat. The "building" has insufficient redundancies/physical protection and most part of the "building" would be only functional again after a considerable period of time after an incident.
Medium Low	4	Medium Low: A weakness has been identified that makes the asset somewhat susceptible to a hazard or threat. The "building" has incorporated a fair level of redundancies/physical protection and most critical functions would be only operational again after a considerable period of time after the incident.
Low	2-3	Low: A minor weakness has been identified that slightly increases the susceptibility of the asset to a hazard or threat. The "building" has incorporated a good level of redundancies/physical protection and the "building" would be operational within a short period of time after an incident.
Very Low	1	Very Low: No weaknesses exist. The "building" has incorporated excellent redundancies/physical protection and the "building" would be operational immediately after an incident.
* Note ""building"" is used in this table as a generic term for critical assets and thus stands for other structures and infrastructure elements (e.g., lines, pump stations) as well as buildings per se.		

5.4 RISK CHARACTERIZATION – DEMOGRAPHICS AND ENERGY

5.4.1 Service Areas and General Population

Another factor in understanding Risk and threats to the energy delivery system is its correlations between demographics and geography. The City already well understands the implications geographically since all of its infrastructure and critical facilities (e.g., potable water, fire stations) have well defined and mapped service areas. Hence, an energy disruption at any given facility or infrastructure element will quickly be tagged as affecting the associated service area, which can of course be easily correlated[65] to the overall population served in that area.[66]

5.4.2 At Risk Populations

Furthermore, the impacts of energy disruptions can be calculated for at risk populations. In fact, the 2008 Salem Natural Hazard Mitigation Plan,[67] indicates that the City in each 5-year update Risk Assessment "the community should take into account the following when updating its vulnerability assessment: new buildings that house special high-risk populations (i.e., elderly, low-income, disabled)." For a Local Energy Assurance Plan to be truly effective it should take into account the population affected by disruptions in electric supply. Impacts of an electrical service disruption could be significantly greater for certain segments of Salem's population, especially the elderly, mobility-impaired, those with documented mental disabilities, as well as facilities that serve these populations.

There are approximately 21,000 individuals (more than 13% of the total population) with disability status living in the City of Salem.[68] Similarly, nearly 12% of Salem's population is over 65 years of age, 6% of which are over the age of 75.[69] Many of these residents require uninterrupted electricity to provide them with life-sustaining services, among them may be: medical devices, mobility-aiding devices, heating/cooling (seasonal).

Salem's elderly and mentally impaired populations are served by five facilities; a combination of City and State funding provides care at the following facilities (for the purposes of the LEAP, these facilities are listed as Priority 4 in Chapter 2):

- South Salem Senior Center
- Northwest Senior and Disability Services (2 locations)
- Seniors and Disabled Services
- Harmony House
- Adult Mental Health

[65] For some services (e.g., water, waste water) the population served is in existing data bases such as water bills data cross-indexed with tax lots data, which can be easily mapped and analyzed. Additional data is easily gathered by juxtaposing Census Tract data with service areas.

[66] The City of Salem population in 2009 was approximately 157,000 (still waiting for 2010 census data).

[67] NHMP, Appendix F, P. 9**: "**Salem NHMP Update Meeting # 1**,"** March 19, 2008: 9 -11 am, Salem

[68] U.S. Census Bureau, 2009. American Community Survey: Sex by Age by Disability Status C18101

[69] U.S. Census Bureau, 2010. Summary File 1: Sex by Age P12

Attention must be paid to this segment of the population, as they are highly vulnerable to long-term electrical or natural gas disruption. Such an interruption could pose a significant threat to their health and well-being.

5.5 CONSEQUENCE ANALYSIS

Energy disruptions occur relatively frequently, but most are of short duration or have a very limited geographical scope, or both. Accordingly these common energy disruptions are handled on a routine basis by the energy providers and/or distributers, or end users. Most of these common disruptions go on almost unnoticed by the general public, although some community members may be inconvenienced for a short period of time.

However, if energy disruptions extend over wider geographical areas, impact larger numbers of people and/or a community's critical assets, or are of a longer duration, or any combination of these negative impacts, such events may become "energy emergencies" and could require action by the City or other governmental agencies.

5.5.1 Characteristics of Energy Emergencies

The 2011 Oregon State Energy Assurance Plan (EAP) presents a general working definition of an energy emergency and outlines a variety of factors that could cause such an event.[70]

> *In general, an energy emergency exists whenever supplies of fuels or electricity are inadequate to meet demand. Shortages and disruptions can result from many factors. Threats to the energy infrastructure include:*
>
> *SEVERE WEATHER CONDITIONS: Winter storms, wind storms, drought, and heat waves could stress the energy system as sudden or unexpected surges in demand cannot be met by actual or expected supply levels. Wind storms and freezing rain can also disrupt electrical supply and distribution and hamper transportation.*
>
> *NATURAL DISASTERS: Floods, earthquakes, and tsunami conditions could reduce supply, disrupt distribution, and cause physical destruction of energy systems and/or components. A severe earthquake is likely the Pacific Northwest's most catastrophic event . . .*
>
> *ENERGY INFRASTRUCTURE EVENTS: Spikes in demand during peak energy use, unanticipated power plant or refinery shutdowns, transmission system congestion, and equipment and system failures could result in the reduction of supply and disrupt distribution.*
>
> *NATIONAL SECURITY EVENTS: Acts of terrorism, cyber attacks, and sabotage could result in the physical destruction of energy systems and/or components, increase demand for fuels, and also reduce the fuel supplies available to the United States.*
>
> *POLITICAL FACTORS: Oil embargos, war, and the mobilization of defense resources could create a sudden surge in demand. These events could also reduce the fuel supplies available to the United States.*

[70] Oregon State Energy Assurance Plan (March 2011), Pages 40-41.

MARKET RELATED EVENTS: A sharp, sudden escalation in the price of energy products could result from a curtailment of supplies and stocks. These conditions could reduce demand for conventional energy resources.

Regardless of the origins of an energy emergency event in the City of Salem, and beyond, the consequences are much the same for emergencies of the same duration and in the same energy sector(s). For example, if the electrical supply to the City of Salem is disrupted by a winter storm, flooding in August, or a technological failure of the distribution grid, the community and its critical assets are deprived of their normal electrical supply. Emergency responders – especially those in the field -- will take action appropriately for each different type of hazard event based upon their Standard Operating Procedures (SOPs). However, for purposes of this Energy Assurance Plan (EAP) those tasked with handling energy emergencies will precede in much the same fashion (see Annex Y to the Salem Emergency Management Plan).

5.5.2 State Authority and Plans for Energy Emergency Events

It must be recognized that Salem's response to emergency events – like that of all other jurisdictions in the State of Oregon – is subject to the overarching authority and plans of the State of Oregon and ultimately the federal government. The State Energy Assurance Plan (EAP) and associated documents, plans and agencies (e.g., Oregon Department of Energy, Oregon Public Utilities Commission, Oregon Emergency Management) will take precedence over local plans when the State plans are activated after certain thresholds specified in the plans have been reached for certain kinds of energy emergencies (see Chapter 6 of the March 2011 State EAP). The Oregon Petroleum Contingency Plan has four levels of preparedness and response actions based on the severity of supply shortages. Similarly, the State has four levels emergency response phases and actions for electrical disruptions also based on the severity of supply shortages. A plan for natural gas emergencies is also in the preparation at the State level. Accordingly, the energy emergency response actions of the City of Salem will take place within the context established by the State, and will work through the Marion County emergency management structure for many, if not most, emergency situations.

5.5.3 Cascading Effects of Energy Emergency Events

Energy Emergency events often have "cascading effects." Disruptions in one sector have negative impacts on other sectors in a ripple or cascading manor. The State EAP presents a macro overview of how this works at the national or State level.[71]

Critical infrastructures cover a large number of sectors. They include the electric power grid; oil and natural gas production, transportation, and distribution systems; telecommunications and information systems; water systems; transportation networks; the banking and finance industry; agriculture and food systems; and public health networks.

An interdependency is a two-way relationship between infrastructures where the operation of each infrastructure is influenced by the other. For example, the electricity

[71] Oregon State Energy Assurance Plan (March 2011), Pages 10-11.

infrastructure includes a nationwide power grid of long-distance transmission lines that move electricity from region to region, as well as the local distribution lines that carry electricity to homes and businesses. Much of our electricity originates at coal-fired power plants. These power plants require a dependable transportation infrastructure to deliver the coal necessary for the production of electricity.

Electricity is also required for petroleum refinery and distribution terminal operations. A power failure can shut-down the movement of fuel through pipelines. Gasoline and diesel are required by utility vehicles which are often needed to get workers to the field to restore power to the electrical grid. Telecommunication networks often use sophisticated computerized control and. information systems, which rely on electricity.

The State EAP notes that Oregon has many electric generation facilities that are fueled by natural gas,[72] a fact which adds additional layers of complexity to energy disruptions at that level.

At the local level there are a number of risks of cascading effects or downstream consequences of energy disruptions in one or another of the sectors. One common example that would have widespread ramifications, especially in longer duration events, would be the loss of electrical power to service stations that rely on electrical pumps to refuel vehicles.[73] Of course electrical power is essential for many critical facilities and infrastructure elements to function optimally.

Salem Hospital has backup generator capacity with a 96-hour fuel supply on hand, but it will not provide power for all of the hospital's normal electrical needs. The provision of potable water and the functioning of the sanitary sewer system all require electricity. The City has backup generators at many critical locations in these systems. Once again, fuel on hand and re-supply are key issues.

Emergency coordination and communications (e.g., EOC, 911, Departmental Operations Centers, Information Technology) all rely on electrical power – backup generators can supply basic needs as long as fuels supplies can be provided[74]. Backup generators usually cannot provide for all key functions within facilities; as a result, heating and cooling may be compromised in some cases.

Electricity powers street lights and traffic signals – loss of power complicates transportation and the coordination of police services to ensure public safety and the timely routing of emergency vehicles. Information system networks, radio, television,

[72] Oregon State Energy Assurance Plan *(*March 2011), p.76

[73] The City reports that its Fleet Services has a backup generator powering the Shop and the Fuel Island, and has 40 hours of fuel on hand for this backup generator. Accordingly, the City can keep its police, fire, ambulances and public works vehicles in service during an electrical power outage that could cripple many commercial stations. Obtaining additional fuel for the backup generator would be a priority during prolonged electrical power outages.

[74] The Risk Assessment portion of this LEAP study has documented the energy vulnerabilities of many of the City's Critical Facilities and Infrastructure. The results of these assessments are contained in Technical Appendix II (Site Assessment Data).

cell towers all rely on electrical power. Communications of all types are often severely compromised and create major hardships during electrical power outages.

Most power outages in the Salem area to date have been of relatively short duration – from a few hours to a few days in the more extreme cases. However, should there be electrical outages or other energy supply disruptions of long term duration, say a week or more especially in severe weather conditions, the cascading effects would be much more severe. Such longer term impacts could include people displaced from their homes and/or jobs, debilitating costs to state and local government, and significant loss of business income, perhaps even business failures and closures. This has obviously been seen in the aftermath of such major events as the flooding in New Orleans with Hurricane Katrina and its devastating impact on all kinds of infrastructure, but Oregon also knows that much smaller events in the state have led to business closures. Especially vulnerable are those businesses that operate with only a marginal capacity to withstand disruptions to their normal operations.

As noted in Section 4.3.3 above (Chapter 4), a large-scale, or regional disruption in the natural gas system affecting the Salem area could potentially cause electrical disruptions in Salem. Natural gas is used to generate electricity in power plants that are a major source (40%) of Salem's electricity. Hence, a natural gas disruption of sufficient magnitude and duration could have cascading effects in triggering the aforementioned electrical disruption issues and vulnerabilities.

5.5.4 Examples from the City of Salem - Cascading Effects of Energy Emergency Events

With the growing reliance of City facilities' operations on computer network support, technological resources held at the Salem Information Technology building become increasingly important to facility functionality. For example, in the event that the IT building is incapacitated by a fire or small disturbance, the ramifications will be felt in every office operating on the Salem network. Of particular importance are files necessary to addressing emergency situations including City Facility and Infrastructure information, maps, building files necessary for first responders. In addition to key information stored on the City network, email servers and other communication components could be significantly impacted by both a temporary or long-term network interruption.

The loss of IT services would directly impact a broad range of municipal functions. Governance operations out of the Salem Civic Center, including City Hall and the Salem Police would become increasingly difficult as communications would be limited to the phone network. Coordinating response to emergencies could likely be maintained by the independent server of the Emergency Operations Center. However, response times and communications between teams of first responders could be delayed. Processing of Police and Fire documentation could continue, but would likely be significantly hindered.

In larger-scale response efforts, Salem IT becomes increasingly more important in its support of the Situational Awareness Framework for Events (SAFE) system. Real-time tracking of response efforts allows Emergency Operations Management the ability to distribute resources according to the necessity of a given incident. Among the tools available on the SAFE server: downed power lines can be verified to be live, water lines can be located for emergency repair, fires can be tracked and contained, road closures can provide live traffic flow to avert longer emergency response times, just to name a few. In periods of energy disruption the conservation of City resources becomes more significant, making efficiency of response efforts a primary concern.

Upon further conversation with Salem's IT Network Manager, it became clear that restoring Salem's network using its current backup system may pose significant challenges.

Infrastructure, involved with water and wastewater in particular, is controlled through the network server remotely, and would require on-site monitoring to maintain operations.

Figure 5.5 Illustrates yet another situation in which the loss of energy would implicate systems and services beyond the power network. Frame **A** depicts the potable water network in full operation, each of the blue squares indicating an electrically dependent functional water component, the orange line indicating water flow. Frame **B** shows the impacted water flow (no service to the majority of the city) as a result of an event that interrupted flow control, as indicated by a red "x".

FIGURE 5.5: WATER NETWORK CONNECTIONS

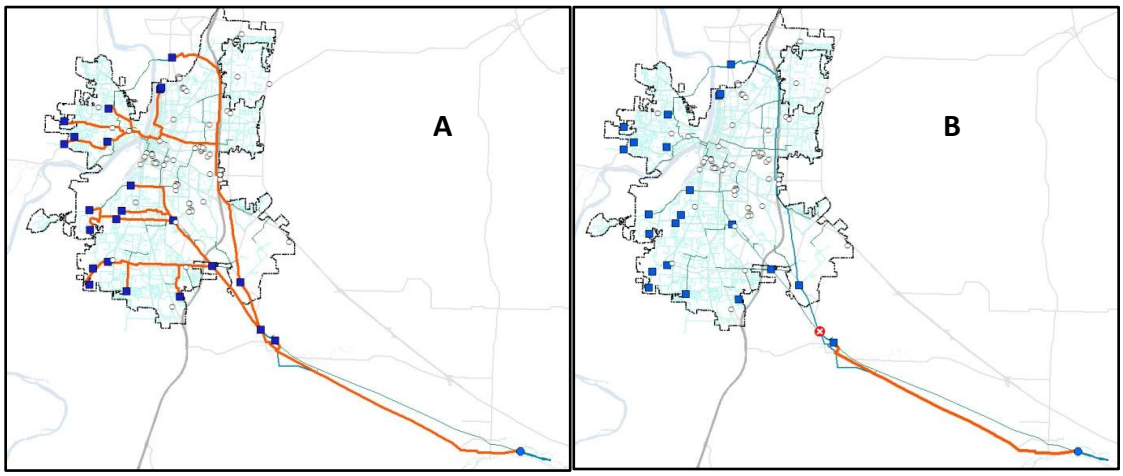
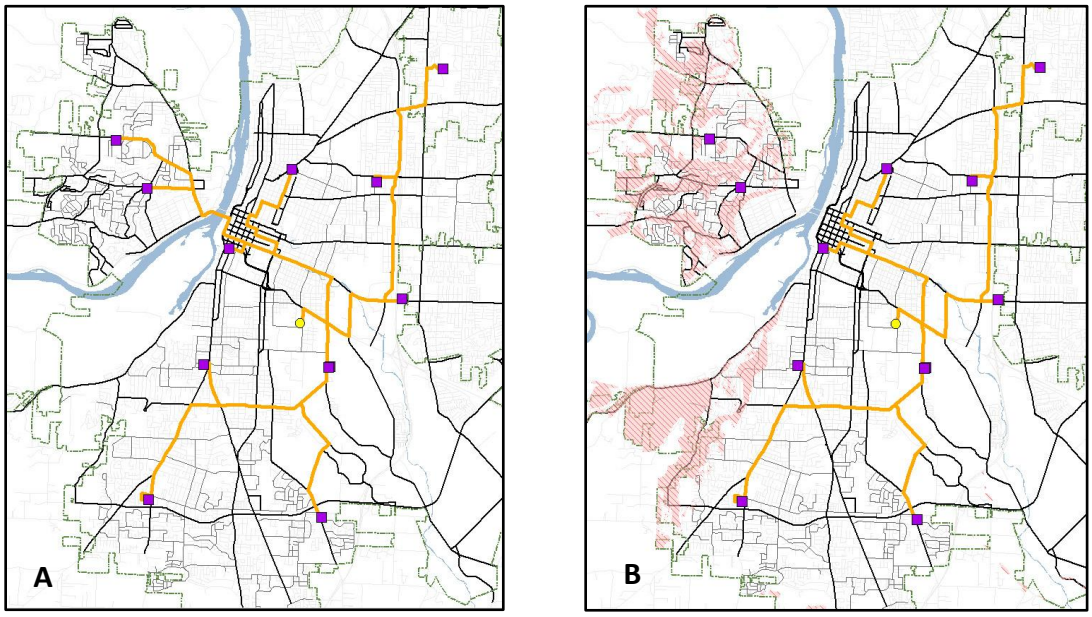


FIGURE 5.6: ROAD NETWORK CONNECTIONS



Maps by University of Oregon InfoGraphics Lab.

Similar to the previous example, **Figure 5.6** displays the network of Critical Facilities (purple squares) connected by the road network in Frame **A**. This road network is crucial to the delivery of petroleum in the event of an emergency, particularly for refueling of diesel power generators. If an earthquake rendered the bridges connecting West Salem to Downtown impassible as in Figure **B**, West Salem's Critical Facilities would not be accessible for refueling.

5.6 Security Environment Assessment: Physical Security; Operations Security; Information System Network Architecture and Penetration Testing

The inventory of Critical Facilities and Infrastructure includes issues concerning physical security. Risks associated with natural disasters or intentional attacks suggest a need for careful physical evaluation of buildings and the operations conducted in and around them. By maintaining the security and the integrity of Critical Facilities, a level of resilience is assured to maintain functionality in the event of a threat or a breach of security, especially for those facilities' primary and backup energy resources.

Complementary to this are digital concerns related to Cyber Security and the integrity of Salem's digital network. With increasing reliance on technology in monitoring and controlling the production and distribution of energy over electrical, oil, and gas infrastructure, the preservation of energy resources in the event of an emergency may rely on the security of the greater network.

Digital security is concerned with multiple facets of Salem's energy network. At the largest scale, reliance on utility providers across multiple state networks requires power providers to share information digitally. Assurance of reliable power requires multiple levels of security and identification of key assets. At the most local scale, the communications network that supports Salem requires different, but no less important safe-guards to ensure continuation of network communications in the event of a long-duration interruption.

5.6.1 Physical and Operations Security

Physical and operations security depends greatly on the safety and security of the facility itself, while also taking precautionary measures to assure secure operations. The City of Salem's critical facilities provide physical measures of security, along with operational protocols to complement these measures.

Salem contains a mix of secured and unsecured (or public access) facilities. Secured facilities often feature:

- Vehicular Gates
- Fenced Perimeters
- Video Surveillance
- ID Badges
- Security Lighting

Unsecured or public access facilities often employ some of these measures (where deemed necessary) to track and record the visitation to critical facilities.

Each of Salem's departments maintain industry-specific standards of security measures for their respective facilities. The Salem Facilities department has referenced a physical security protocol on a very basic level; at this time there is no overall standard protocol for security of City-operated facilities.

5.6.2 Cyber Security

City of Salem Facilities: Cyber security is mainly concerned with the identification and protection of critical electronic devices or network assets that support the operations of the electrical grid, and by extension, the critical functions of the City of Salem.[75]
Bulk Electric System: Guidelines for the protection of cyber assets are concerned primarily in the preservation of service of the "Bulk Electric System" addressing the following[76]:

- Identifying critical cyber assets
- Developing security management controls
- Identifying and training personnel
- Establishing electronic security perimeters
- Assuring physical security
- Assuring systems security
- Establishing incident reporting protocol
- Developing recovery plans for critical cyber assets

These concerns are specifically geared towards the protection of electricity providers, as their facilities, if rendered inoperable, would impact large numbers of customers significantly. Interruptions in electricity to many of the customers of these electric utilities could pose significant public health and safety risks. For these reasons, and in light of national-level cyber security regulation, energy sector cyber security has become particularly relevant.

[75]North American Electric Reliability Corporation, 24 Jan 2011
[76]NERC, CIP-002-4 to CIP-009-4 "Critical Infrastructure Protection" approved 24 Jan 2011

U.S. Department of Energy's Roadmap to Secure Control Systems in the Energy Sector*:* According to the U.S. Department of Energy's *Roadmap to Secure Control Systems in the Energy Sector*,[77] a comprehensive plan for improving cyber security in the energy sector relies on collaboration between the energy sector and government. In the context of the Local Energy Assurance Plan, the City of Salem may work together with private energy companies to apply some or all of the strategies in the *Roadmap* to prevent future cyber-attacks on energy systems and infrastructure.

To best explain the intentions and applications of *Roadmap* strategies*,* this section will address: (1) the purpose of the *Roadmap* for the energy sector; (2) the framework for industry and government to secure energy control systems; and (3) short-term, mid-term and long-term implementation strategies.

As technology becomes the norm in the energy sector, energy systems become more exposed and susceptible to cyber-attack. The interconnected nature of these systems and the potential of widespread impact make energy systems and infrastructure attractive targets. The *Roadmap* by 2016[78] plans for the U.S. energy system to survive intentional cyber-attacks with no loss of critical functions and service.

[NOTE: Some of the implementation strategies are more appropriate for the federal and/or state government because of the availability of resources and jurisdiction.]

a. The *Roadmap* Framework:
To achieve energy system security, the *Roadmap* framework identifies four main goals[79]:

- **Measure and Assess Security Posture.** Utilities should completely understand their current security posture to determine system vulnerabilities and the actions required to address them.
- **Develop and Integrate Protective Measures.** As security risks are identified, protective measures should be developed and applied to reduce system risks.
- **Detect Intrusion and Implement Response Strategies.** Few system are totally impervious to cyber-attacks at all times, therefore, companies should possess sophisticated intrusion detection system and a sound response strategy.
- **Sustain Security Improvements.** Maintaining aggressive and proactive control system security over the long term will require a strong and enduring

[77] *Roadmap to Secure Control Systems in the Energy Sector.* January 2006. Sponsored by the U.S. Department of Energy and U.S. Department of Homeland Security. Prepared by Energetics Incorporated located in Columbia, Maryland.
[78] Ten years after report was published.
[79] *Roadmap to Secure Control Systems in the Energy Sector.* January 2006. Sponsored by the U.S. Department of Energy and U.S. Department of Homeland Security. Prepared by Energetics Incorporated located in Columbia, Maryland. Pg. 2.

commitment of resources, clear incentives, and close collaboration among stakeholders.

b. Local Relevance:

The last goal, to **Sustain Security Improvements**, is especially relevant to a local government working with the private energy sector and utilities. While much of the cyber security efforts are completed within the private energy sector, it is important for governments to work together with utilities and other energy companies to ensure that their systems are protected and secure from current and future cyber-attacks.

In keeping with the *Roadmap's* general pattern, similar NERC Standards require documentation, evaluation of weakness, and monitoring of critical cyber assets. Physical and system security is documented particularly in reporting incidents along with recovery plans for these assets.[80]

Governments rely on the energy sector to power almost all critical infrastructure; without power their functionality is significantly impaired. The following section provides specific implementation strategies that governments can do to work in collaboration with the energy sector.

c. Implementation Strategies

To provide energy system security it is important for governments to collaborate with energy companies and utilities. The framework goal, to Sustain Security Improvements provides government, at both high- and local-levels, the opportunity to work together with the energy sector companies. The City of Salem's energy supply, under the jurisdiction of the Public Utilities Commission, is governed by Interconnection Agreements specifically between Bonaville Power Administration and Investor-owned Utilities such as Salem Electric. North American Electric Reliability Corporation (NERC) standards guide these "Responsible Entities" to take a systematic approach to cyber security.[81]

The Roadmap outlines short-term, mid-term, and long-term implementation strategies to achieve compliance with NERC standards and provide secure energy systems.

Short-Term (0-2 years)

- Major Information protection and sharing issues resolved the U.S. government and industry.
- Industry-driven awareness campaign launched.
- NERC compliance with CIP-002-4 through CIP-009-4

[80]NERC CIP-009-4 "Recovery Plans for Critical Cyber Assets"
[81]NERC CIP-002-4, Requirement 3

Mid-Term (2-5 years)

- Secure forum for sharing cyber threat and response information.
- Improvement and evaluation of recovery plans for critical cyber assets.[82]
- Compelling, evidence-based business case for investment in control system security.
- Undergraduate curricula grants, and internship in control system security.
- Effective federal and state incentives to accelerate investment in secure control system technologies and practices.

Long-Term (5-10 years)

- Cyber security awareness, education, and outreach programs integrated into energy sector operations.
- Energy asset owners and operators working collaboratively with government and sector stakeholders to accelerate security advances.

d. Cyber Security Conclusion

Cyber security is essential in creating a resilient and secure energy system. The City of Salem may not be able to directly implement the *Roadmap* strategies at the local level, but they can work with their utility providers, as well as state and federal government to make a case for the security strategies of the *Roadmap* as well as maintain compliance with NERC standards to protect all vulnerable energy systems from cyber threats.

5.7 Protection of Sensitive -- Information Disclosure Recommendation

Much of the information gathered for this LEAP report, especially the Risk Assessment is sensitive to private energy providers, the City of Salem, or both. Given the sensitive nature of the information collected for this report, certain legal parameters are relevant and should be "cross-walked" between the following documents: (1) Department of Homeland Security policies; (2) City of Salem public records policy; (3) Oregon Revised Statutes (ORS). The relevant policies are outlined below. Based on these polices, the UO CSC LEAP Team provides recommendations to the City of Salem to harmonize public disclosure law with the sensitivity of the information collected.

5.7.1 Department of Homeland Security Guidelines

The Department of Homeland Security policies that are relevant to LEAP include the Freedom of Information Act (FOIA). The FOIA is the federal freedom of information law that allows for full or partial disclosure of previously unreleased information and current documents that are controlled by the United States Federal Government.

However, the FOIA has nine categories of information that may be exempted from disclosure. Three of the nine exemptions provide possible protection against the

[82]NERC CIP-009-4

release of critical infrastructure information[83]: exemption 1 (national security information); exemption 3 (information exempted by statute); and exemption 4 (confidential business information).

Exemption 1 of the FOIA protects from disclosure national security information concerning the national defense or foreign policy, provided that it has been properly classified in accordance with the substantive and procedural requirements of an executive order.

Exemption 3 statute is exempt from disclosure only if the other statute meets any one of the three criteria:

1. It requires that the records be withheld (i.e., no agency discretion),
2. Grants discretion on whether to withhold but provides specific criteria to guide the exercise of that discretion; or
3. Describes with sufficient specificity the types of records to be withheld.

Exemption 4 of FOIA exempts from disclosure "trade secrets and commercial or financial information obtained from a person and privileged or confidential."[84] This may apply to information relating to critical infrastructure, particularly information from privately utility companies. The 'commercial information that is privileged or confidential' is especially relevant to the issue of the federal government's protection of private sector critical infrastructures information.

It should be repeated that the FOIA applies to federal information only. Additionally, Oregon has its own information disclosure policy that applies more directly to the City of Salem.

[83] The Homeland Security Act defines critical infrastructure information to mean "information not customarily in the public domain and related to the security of critical infrastructure or protected systems—

a. actual, potential, or threatened interference with, attack on, compromise of, or incapacitation of critical infrastructure or protected systems by either physical or computer-based attack or other similar conduct (including misuse of or unauthorized access to all types of communications and data transmission systems) that violates federal, state, or local law, harms interstate commerce of the United States, or threatens public health and safety;
b. the ability of critical infrastructures or protected systems to resist such interference, compromise, or incapacitation, including any planned or past assessment, projection or estimate of the vulnerability of critical infrastructure or a protected system, including security testing, risk evaluation thereto, risk management planning, or risk audit; or,
c. Any planned or past operational problem or solution regarding critical infrastructure...including repair, recovery, reconstruction, insurance, or continuity to the extent it relates to such interference, compromise, or incapacitation."

[84] 5 U.S.C. § 552(b)(4).

5.7.2 Oregon Revised Statutes Public Records Law

Oregon Public Records law defines a public record as: "any writing containing information relating to the conduct of the public's business, including but not limited to court records, mortgages, and deed records, prepared, owned, used or retained by a public body regardless of physical form or characteristics."[85]

The Oregon Public records law applies to all government records and writing, but it does not apply to the private utility companies. In general, the law favors disclosure as the rule, and government agencies have the burden of proving the need for an exemption in order to withhold information from the public.

5.7.3 City of Salem Information Disclosure Law

The City of Salem has its own information disclosure policy. The City of Salem policy is consistent with the federal and state laws. The public disclosure policy states that:

> *"The City of Salem recognizes that Oregon Public Records Law (ORS 192.410-192.505) gives members of the public the right to inspect and copy certain public records maintained by the City. The City also recognizes that certain records maintained by the City are exempt from public disclosure, or that disclosure may require balancing the right of the public to access the records against individual privacy rights, governmental interests, confidentially issues and attorney/client privilege."* [86]

The City of Salem information disclosure policy is fairly vague for what is exempt from public record disclosure. Many times the information is disclosed on a case-by-case basis, depending on the approval of the City Attorney.

5.7.4 Recommendations

There is a reluctance by the private sector to share information to the public sector related to vulnerabilities or potential emergency events requiring pre-planning that might damage its reputation, weaken its competitive position, lead to costly investigations, be used inappropriately, or expose it to liability as a result of disclosure by the government of confidential business information.[87] Furthermore, it is a topic of debate by many in emergency management circles and private energy providers and distributers whether or not sensitive information if disclosed could be used by terrorists to damage the energy distribution system. Also, government is reluctant to disclose threat information that might compromise intelligence activities or investigations.[88]

However, the following recommendations can help address these concerns and issues related to information sharing about critical facilities and infrastructure, by both the public and private sector.

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[85] ORS 192.410 (4).
[86] City of Salem Public Records Policy. Page 1.
[87] Moteff, John D. and Gina Stevens. *Critical Infrastructure Information Disclosure and Homeland Security.* Congressional Research Services, The Library of Congress. Updated January 29, 2003.
[88] Moteff, John D. and Gina Stevens. *Critical Infrastructure Information Disclosure and Homeland Security.* Congressional Research Services, The Library of Congress. Updated January 29, 2003.

1. The City of Salem should assure the private sector that its confidential information would be protected from public disclosure. This may require that a legal framework (e.g., confidentiality agreements) be established within information sharing mechanism regarding critical facilities and infrastructure in order to protect confidential information.
2. The City of Salem should evaluate what information from the LEAP document, its technical appendices, and its accompanying annexes should be disclosed as to the public and what information should be exempted from being made available to the public, in keeping with federal, state and local law. The information open to the public should be updated and also kept consistent with federal, state and local disclosure laws, as these laws may change.
3. The City of Salem should revise their information disclosure policy to include matters relating to energy supply, distribution and consumption as both public safety issues and as "commercial information that is privileged or confidential." These revisions will help to protect vulnerable systems for both the public and private entities.

Attachment 5.1: City of Salem's Comprehensive* List of Threat or Hazard Events
Table A5.1

1. Natural Hazards

1.1 Flooding
1.2 Landslide/Mudslide/Debris Flow
1.3 High Winds
1.4 Snow / Ice
1.5 Prolonged Drought
1.6 Wildland/Urban Interface Fire (Not Arson)
1.7 Earthquake - Cascadia (3-5min)
1.8 Earthquake - Crustal (1 min)
1.9 Volcanic Eruption
1.10 Coastal Tsunami Inland Effects (e.g., Mass Evacuations from coastal areas)
1.11 Public Health Emergency (e.g., Epidemic, Pandemic)
1.12 Solar Flares (e.g., solar coronal mass ejections resulting in geomagnetically induced currents and damage in electric grid system infrastructure – lines, compensators and transformers, etc.)

2. Technological System Failures (Accidental)

2.1 Electrical Power Disruption
2.2 Natural Gas Supply Disruption
2.3 Vehicle Fuel Supply Disruption
2.4 Propane Supply Disruption
2.5 Failure of Major [Critical] Public Facility or infrastructure component (e.g., Water Treatment Plant, Sewage Treatment Plant) or Public Utility
2.6 Telecommunications System Failure
2.7 IT Infrastructure Disruption
2.8 Major Fire- Commercial
2.9 Major Fire - Residential
2.10 Major Fire - Public/Governmental Building
2.11 Major Transportation Related Accident Closing Key Life Line(s)
2.12 Accidental Hazmat Release
2.13 Accidental Radiological Material Release

3. Intentional Human Attacks

3.1 Human Violence

3.1.1 Misinformation / Disinformation
3.1.2 Bomb Threat
3.1.3 Workplace or School Violence
3.1.4 Sports/Public Event Disturbance
3.1.5 Civil Disturbance / Protest / Demonstration
3.1.6 Riot

3.2 Terrorism

3.2.1 Animal / Eco-terrorism
3.2.2 Cyber Terrorism
3.2.3 Arson
3.2.4 Mail/Package Bomb
3.2.5 Active Shooter
3.2.6 Truck (Vehicle) Bomb
3.2.7 Sabotage of Major [Critical] Public Facility or infrastructure component (e.g., Water Treatment Plant, Sewage Treatment Plant) or Public Utility
3.2.8 Intentional Biological Agent Release
3.2.9 Intentional Radiological Material Release

***** *While this list of threats is intended to be comprehensive in terms of covering the possible types of threats and hazard events, it makes no pretense of being an exhaustive listing of the multitude and variety of threats and hazard events that any community could face.*

CHAPTER 6: POLICY AND PROCEDURE RECOMMENDATIONS

6.1 INTRODUCTION

After careful examination of the City of Salem's energy-related policies and procedures, a number of observations and recommendations can be made regarding the ability of the City to respond to energy emergencies, the resilience of its critical operations, and its ability to plan and better prepare for energy disruptions going forward. Periodically, policy and regulations regarding energy should be reviewed and amended as necessary to incorporate energy resilience objectives. Both short- and long-term strategies for Salem are included in this chapter.

Existing documents, such as the Emergency Management Plan (SEMP) and the City's Continuity of Operations Plan, guide the City's ability to respond to immediate emergencies, providing the basis for decision-making during an emergency and the immediate aftermath. Many of the recommendations stemming from these procedures aim at enhancing the ability of Salem to mitigate such emergency situations.

Beyond mitigation is the ability of Salem to better strategize for energy resilience and independence in the future. The efficacy of emergency management hinges, over the long-term, on preparedness for any given emergency. In this case, Salem may be able to avoid the effects of energy disruption by considering energy-related improvements to both City policy and procedure. Specifically, changes to the City Code can further improve resilience by targeting key areas which may in the short-term encourage efficiency and security, but in the long-term provide the opportunity for energy independence.

6.2 LOCAL ENERGY ASSURANCE PLAN GOALS

The ultimate goals of the Local Energy Assurance Plan (LEAP) are to improve the City of Salem's resilience to energy interruption. Energy resilience is more than simply hardening specific facilities or infrastructure. It involves a whole-systems approach incorporating a diversity of strategies, such as eliminating inherent structural vulnerabilities, minimizing dependence on energy supplies, and increasing energy independence.[89] In doing so, Salem may reduce the likelihood of energy emergencies; reduce the potential severity and duration of energy emergencies; and increase the reliability of access to the energy that underlies every aspect of residents' lives and the economy.

Salem's LEAP seeks to address energy emergencies parallel to the Four Phases of Emergency Management:

> ***"All Phases:*** *The Comprehensive Emergency Management Model[90] on which modern emergency management is based defines four phases of emergency management: mitigation, preparedness, response, and recovery.*
>
> ***Mitigation*** *consists of those activities designed to prevent or reduce losses from disaster. It is usually considered the initial phase of emergency management, although it may be a component of other phases.*
>
> ***Preparedness*** *is focused on the development of plans and capabilities for effective disaster response.*
>
> ***Response*** *is the immediate reaction to a disaster. It may occur as the disaster is anticipated, as well as soon after it begins.*
>
> ***Recovery*** *consists of those activities that continue beyond the emergency period to restore critical community functions and manage reconstruction.[91]*
>
> *Detailed planning and execution is required for each phase. Further, phases often overlap as there is often no clearly defined boundary where one phase ends and another begins. Successful emergency management coordinates activities in all four phases."*[92]

[89] Public Technology Institute, *Local Government Energy Assurance Guidelines, v.2* (Washington, DC: U.S. Department of Energy, 2011)
[90] National Governors' Association. *1978 Emergency Preparedness Project: Final Report*. Washington, DC:NGA, 1978.
[91] William L. Waugh, Jr. *Living with Hazards, Dealing with Disasters: An Introduction to Emergency Management.* Armonk, New York: M.E. Sharpe, 2000.
[92] Oregon Emergency Management Association, 2007. P. 5

By focusing on the Mitigation, Preparedness and Response phases of this model, the strategies offered in this chapter can succinctly address energy-related issues that may arise in any type of emergency the City of Salem may encounter. With this in mind, the recommendations included in this chapter help achieve resilience and enhanced emergency response through efforts to achieve the following five key LEAP goals.

Goal I. Energy Security: Improve the energy security of Salem City government and community facilities through secure location choice, site design, and full-systems thinking.

Goal II. Energy Efficiency: Increase energy efficiency and decrease total energy consumption by Salem City government and community facilities.

Goal III. Energy Independence: Improve the energy independence of Salem City government and community facilities through expanded storage capacity and on-site or local generation.

Goal IV. Planning, Policy, Regulatory, and Cultural Environment: Create a planning, policy, regulatory, and cultural environment that fosters long-term investment in energy resilience by the City of Salem and local private entities.

Goal V. Enhanced Emergency Response to Energy Disruptions: Enhance the efficiency and effectiveness of emergency response to energy disruptions. The emergency response recommendations are addressed in **Section 6.6** of this chapter and in the proposed **Annex Y** to the Salem Emergency Management Plan (SEMP).

Each LEAP goal is meant to augment and improve all phases of the Comprehensive Emergency Management Model particularly for the purpose of energy assurance in the City of Salem. The recommendations to follow have been structured to meet these goals over the long-term.

6.2.1 Energy Security [LEAP Goal I]

The recommendations of this chapter are intended to improve the energy system in a way that reduces vulnerability to disruptions. At the simplest level this means ensuring that critical facilities are: (1) secure; (2) sited to minimize risk from natural hazards; and (3) built to withstand potential natural hazards. Ultimately, though, energy security should be pursued at a whole-system level. Each facility is only as secure as the least-secure link in its energy supply chain. An energy-secure energy system avoids “choke points”, minimizes the distance between generation and consumption, and builds in flexibility so that resources can be put to their best use in unforeseen circumstances.

LEAP Goal I relates to Goal 2 of Salem’s Community Energy Strategy (SCES): “Increase renewable energy used or produced by Salem residents and businesses, while decreasing total energy consumption.” It also aligns with Goals 1 and 2 of Salem’s Natural Hazards Mitigation Plan (NHMP): “Develop and implement mitigation activities to protect human life” and “Protect existing buildings and infrastructure as well as future development from the impacts of natural hazards,” and it is supported by Goal 5

of the same plan: "Preserve and rehabilitate natural systems to serve natural hazard mitigation functions and protect natural resources."

6.2.2 Energy Efficiency [LEAP Goal II]

Another way to improve energy resilience is to reduce the amount of energy needed for facilities to perform their functions in the first place. This has two benefits: it allows backup energy supply capacity to go farther and it decreases the level of on-site generation capacity needed for continued functionality.

Improving energy efficiency and reducing demand is in line with Salem Community Energy Strategy (SCES) Goals 1, 2, and 5. SCES Goal 1 is to "Improve energy efficiency in buildings community-wide," SECS Goal 2 is to "Increase renewable energy used or produced by Salem residents and businesses, while decreasing total energy consumption," and SECS Goal 5 includes a public education component aimed at reducing energy consumption.

LEAP Goal II is also in line with Goals 1 and 2 of Salem's NHMP: "Develop and implement mitigation activities to protect human life" and "Protect existing buildings and infrastructure as well as future development from the impacts of natural hazards."

6.2.3 Energy Independence [LEAP Goal III]

The vast majority of energy consumed in Salem is imported. While total energy independence is a long ways off for Salem, steps can be taken in the short-term to increase the community's energy independence. For example, fuel storage capacity and backup electrical generators are important tools of energy resilience because they increase the amount of time that a facility can continue to function more or less normally without normal access to energy. Most Salem facilities with backup capacity are estimated to be able to continue operating for 1-3 days on their reserves. Although this is a great start, it will be insufficient in the face of longer energy disruptions, as might occur in the case of a major earthquake.

On-site renewable generation (solar, wind, micro-hydro, etc.) is an even better way to improve energy independence. A facility that can meet all of its energy needs in such a way would be able to operate for an effectively limitless amount of time without refueling. Unfortunately, there are many challenges (real and perceived) to increased adoption of renewables, such as higher cost, changing technology, and concerns about reliability.

Improving energy independence aligns with Goal 2 of Salem's Community Energy Strategy, to "Increase renewable energy used or produced by Salem residents and businesses, while decreasing total energy consumption." LEAP Goal III also aligns with Goals 1 and 2 of Salem's Natural Hazards Mitigation Plan (NHMP): "Develop and implement mitigation activities to protect human life" and "Protect existing buildings and infrastructure as well as future development from the impacts of natural hazards."

6.2.4 Planning, Policy, Regulatory, and Cultural Environment [LEAP Goal IV]

The need for energy resilience is pressing today, but it will only become more so in the future with rising demand, resource depletion, and a likely increase in natural hazard frequency and severity due to climate change. In addition to implementing energy resilience strategies now, Salem should foster an environment where investments in energy resilience are easy and attractive choices. This will help ensure that energy resilience continues to improve over the long term, keeping pace with growing challenges.

LEAP Goal IV is in line with Salem's Community Energy Strategy Goal 5: "Conduct a public participation program that engages the community and communicates the value of energy savings and greenhouse gas reduction community-wide." LEAP Goal IV also supports (1) Salem's NHMP Goal 2, "Protect existing buildings and infrastructure as well as future development from the impacts of natural hazards" and (2) Oregon State Planning Goal 13, "to conserve energy."

6.2.5 Enhanced Emergency Response to Energy Disruptions [LEAP Goal V]

The emergency response recommendations are addressed in **Section 6.6** of this chapter and in the proposed **Annex Y** to the Salem Emergency Management Plan (SEMP).

6.3 MITIGATION

As mentioned in Chapter 1 and elaborated by Oregon Emergency Management Association (OEMA), "***Mitigation*** consists of those activities designed to prevent or reduce losses from disaster. It is usually considered the initial phase of emergency management, although it may be a component of other phases." All phases being important, "[s]uccessful emergency management coordinates activities in all four phases."[93]

Traditional response to the vulnerabilities of the energy system has often focused on hardening infrastructure against damage from natural hazards and preventing damage in the first place. Although in many cases these efforts are effective, no facility or system is 100% damage-proof. As noted in Chapter 5 of this LEAP Report, given the variety and magnitude of hazards Salem could face, it is inevitable that Salem's energy system will be disrupted from time to time. As mentioned in the PTI Guidelines:

> *"Energy emergency response procedures must provide for sufficient communications to energy providers and key response personnel; ensure the operation of emergency power generators; arrange necessary fuel stocks for prolonged energy disruptions; and improve mutual aid and contractual arrangements for fuel distribution."*[94]

[93] Oregon Emergency Management Association. *Principles of Emergency Management* (2007), p.5

[94] Public Technology Institute, *Local Government Energy Assurance Guidelines, v.2* (Washington, DC: U.S. Department of Energy, 2011)

In conjunction with current efforts to enhance Salem's ability to mitigate energy disruptions, a systematic approach should be taken to ascertain the current status of energy resilience. By conducting an audit of City facilities, improving the energy efficiency requirements of building codes, and building energy efficiency into procurement policies, the City of Salem can increase their ability to recover from to energy disruptions.

6.3.1 Conduct Energy Audit of all Existing City Facilities

The City of Salem should conduct a thorough energy audit of all of its facilities, prioritizing top tier critical facilities but including all City-operated facilities and infrastructure such as street lighting. The purpose of this audit is to assess the energy needs and vulnerabilities of each facility, including:

- Physical risks and vulnerabilities to the energy system;
- Energy requirements for core critical functions;
- Efficiency of energy use by the facility; and
- Existing backup and onsite generation capacity.

The findings from the audit would be used to target and reduce the threat of vulnerabilities, improve total energy efficiency, and augment backup and onsite generation capacity. They would also be used to establish an inventory of City energy use, which should be updated periodically to maintain accuracy.

1. Rationale

Many of Salem's critical facilities are vulnerable to energy emergencies, either because they have been built in areas at risk from natural hazards[95], rely on vulnerable resource supply chains, or lack sufficient backup capacity to see them through an extended energy disruption. However, there has been no comprehensive audit of facilities to identify energy needs, vulnerabilities, and opportunities for improvement. By conducting such an audit Salem can improve energy resilience in a timely and cost-effective manner, targeting those facilities with the most urgent needs and the greatest potential for improvements.

This recommendation lays the groundwork for achieving LEAP Goals 2 and 3 noted above in this chapter: to foster energy efficiency and increase energy independence. It is also in line with Goals 1 and 2 of the Community Energy Strategy and Goal 2 of the Salem's NHMP.

[95] 7 Obviously, given the nature of some critical facilities and infrastructure (e.g., pump stations), they must be sited in areas at risk from some natural hazards.

2. Implementation

The first steps towards implementing this recommendation for an energy audit have been completed as part of the City's LEAP efforts. As noted in Chapter 2 of this LEAP Report, the LEAP Team from the University of Oregon developed a framework for assessing the energy needs, vulnerabilities, and opportunities of critical facilities, and initiated the process of collecting data and populating an inventory. The LEAP Team's efforts focused on Priority 1 critical facilities; however, not all have been included in this first phase conducted by the UO CSC LEAP Team.

- The City should complete assessments of all critical City facilities over the course of the next two years using the Critical Facilities Site Assessment methodology outlined in this LEAP report.
- The database of facilities generated via this process should be maintained by periodically (every 5-10 years) reassessing facilities.
- To streamline the process, these energy assessments could be incorporated into the City's existing asset management efforts by adding an increased energy focus to current building inventory and inspection practices.

6.3.2 Adopt Energy Efficient Building Standards for City Buildings

1. Overview

The City of Salem should adopt a set of energy efficiency or "green building" standards for all City-owned facilities, and provide optional certification services for privately-owned buildings. The standard would be similar to LEED and other green building standards such as Green Globes or the National Green Building Standard, but would be tailored to Salem's needs and focus on energy issues.

A Salem Efficient Building Standard would use existing green building standards as a starting point, and would assess facilities based on typical green building criteria such as[96]:

- Site Design;
- Resource Efficiency;
- Energy Efficiency;
- Water Efficiency;
- Indoor Environmental Quality; and
- Operations, Maintenance, and Public Education.

However, the focus would be given to aspects of the design that affect energy resilience of that facility or of the community as a whole. Some examples might include orienting buildings for passive solar heating, effectively insulating, using high-efficiency lighting and appliances, and minimizing outputs such as wastewater that impose energy requirements on other "downstream" facilities.

[96] National Association of Homebuilders Research Center, *Green home Rating Comparison* (Upper Marlboro, MD: National Association of Home Builders, 2008).

Models such as the National Green Building Standard are designed for assessment of residential buildings but could provide a good basis for Salem's own standard. The National Green Building Standard focuses much of its assessment on energy efficiency (building materials, system efficiency) and opportunities for passive energy collection (through lot and building orientation).

2. Rationale

Salem's City-operated buildings rely on traditional sources of power and typically were not designed to consider energy efficiency or resilience—at least not to contemporary standards. Enacting a green building standard for City facilities would increase existing buildings' energy efficiency and improve the energy resilience of future construction. Furthermore, by establishing such a standard for its own facilities, the City would lead the way within the community; improve access to certification for private buildings; and act as a model for other communities looking to improve energy resilience.

The downsides of existing green building standards are that they tend to be focused on residential buildings, do not focus on energy efficiency, and carry a high cost of certification. An in-house standard would take some time to develop, but would yield benefits in terms of certification cost savings and relevance to local facilities and priorities.

The adoption of a Salem Efficient Building Standard aligns with LEAP Goals II, III, and IV in this chapter: to improve energy efficiency, to foster energy independence, and create an environment that encourages energy resilient investments. It also aligns with Statewide Planning Goal 13 (energy conservation), Salem Community Energy Strategy Goals 1 (improve energy efficiency) and 2 (increase renewable energy generation), and section 2.6.3 of the PTI Local Energy Assurance Guidelines (improve energy efficiency).[97]

3. Implementation

Implementation of this recommendation would include the following:

- Review existing green building standards—particularly communities that have developed standards for city facilities—and use them as a basis for a Salem Efficient Building Standard, tailored to the City's energy resilience needs.
- Require that all new City facilities adhere to these standards.
- Include a less stringent set of standards for existing facilities, and require that all existing City facilities upgrade so as to be compliant with those standards within a specified time frame.
- Offer green building standard certification to private building owners at cost. This would provide a revenue-neutral way for the City to support energy efficiency in the community.

[97] Public Technology Institute, *Local Government Energy Assurance Guidelines, v.2* (Washington, DC: U.S. Department of Energy, 2011).

6.3.3 Institute a Consistent Procurement Policy that Supports Energy Efficiency and Resilience

1. Overview

The City should institute a revision to its procurement policy that incorporates "life-cycle" costing. These standards of energy efficiency and resilience should be considered in purchasing decisions rather than solely basing such decisions on lowest up-front cost. A new procurement policy would focus on life-cycle costs and give more weight to energy efficiency and energy resilience, and allow Salem staff to incorporate energy assurance into the daily operations of City government.

The City's revised procurement policy should call on established criteria for energy efficient products. The Energy Efficient Procurement Policy Guide[98] suggests a number of useful resources for this purpose: the EAP's Comprehensive Procurement Guideline[99], EPA's EPP Web Site[100], Energy Star[101], and the Office of the Federal Environmental Executive[102]

These criteria cover the purchase of a wide range of goods, including:

- Lighting;
- Heating;
- Air conditioning;
- Electronic goods (e.g. audio-visual, ICT, printers and photocopiers, etc.);
- White goods (e.g. refrigerators, cookers, etc.); and
- Vehicles.

2. Rationale

An energy resilient procurement policy would recognize that often the best purchase for the City may not be the one with the lowest price tag. One reason for this is that cost savings may accrue over time. For example, compact fluorescent lights (CFLs) are more expensive than incandescent lights but last longer and use less electricity, costing less in the long run. Another reason is that the purchase might insure the City against an unlikely but potentially harmful event. For example, surge protectors cost money and provide no service – unless there is a power surge, at which point they become vitally important.

By creating an environment of energy consciousness through procurement, the City of Salem would be able to see immediate operational efficiency increases. In a prolonged

[98] ICLEI - Local Governments for Sustainability, *The DEEP Toolkit. TOOL 1.a: The Energy Efficient Procurement Policy Guide* (Freiburg, Germany: ICLEI, 2007).
[99] U.S. Environmental Protection Agency, *Comprehensive Procurement Guidelines* (Washington, DC: U.S. EPA, 2011).
[100] U.S. Environmental Protection Agency, *Environmentally Preferable Purchasing* (Washington, DC: U.S. EPA, 2011).
[101] U.S. EPA & DOE, *EnergyStar.gov*, 2011
[102] U.S. Office of the Federal Environmental Executive, *OFEE.gov*, 2011

emergency event, these efficiencies would allow a facility to maintain operations on its backup energy supply for an exponentially longer period of time.

Such a policy would be forward-thinking, but has been adopted elsewhere. For example, the City of Portland's procurement policy states that "City employees will procure materials, products or services in a manner that integrates fiscal responsibility, social equity, and community and environmental stewardship."[103]

Instituting and energy-oriented procurement policy is in line with all four of this chapter's LEAP Goals, but it particularly supports LEAP Goal IV, to "foster an environment where investments in energy resilience are easy and attractive choices." This recommendation is also in line with Goal 1 of the Salem Community Energy Strategy, to improve energy efficiency.

3. Implementation

Implementation of this recommendation would include the following:

- Use existing procurement policies and energy efficient purchasing standards to draft an energy resilient procurement policy for the City of Salem.
- Develop additional standards, such as life-cycle cost, as needed in areas where external authorities have not already established criteria. For example, simple energy efficiency is a well-established metric, but ability to withstand energy disruptions may not be.
- Adopt the procurement policy and require that all City departments use it when making purchases.
- Periodically update the policy according to changing technology and market realities.
- Use facility energy audits (see 4.1.1 above) both to inform and prioritize purchasing policy and to measure the success of the new procurement policy over time.

6.4 Preparedness

The extent to which the City of Salem is prepared to mitigate energy disruptions can be significantly helped or hindered by policy and procedural factors. Preparedness can "range from prevention and protection through mitigation, response, and restoration" according to the PTI Guidelines, with each community requiring a tailored approach.

Specific to Salem are a number of critical adjustments to improve preparedness, many based in policy to improve resilience and energy independence. Preventative measures, such as siting critical facilities and localization of energy storage, combined with proactive measures such as streamlining permitting for renewables, establishing solar access codes and standards, and supporting electricity Advanced Monitoring Infrastructure could better-prepare Salem for an energy emergency.

[103] City of Portland, *City of Portland Sustainable Procurement Policy* (Portland, OR: City of Portland, 2011).

6.4.1 Site Critical Facilities and Infrastructure in Secure Areas

1. Overview

The City of Salem should, when feasible, locate all new critical public facilitates and infrastructure out of hazards areas. As noted in Chapter 5, hazards can include, but are not limited to, flood plains and floodways, steep slopes, and the wildland-urban interface. The hazard areas are documented in a variety of studies for the City of Salem, including the NHMP and the Salem Emergency Management Plan (SEMP).

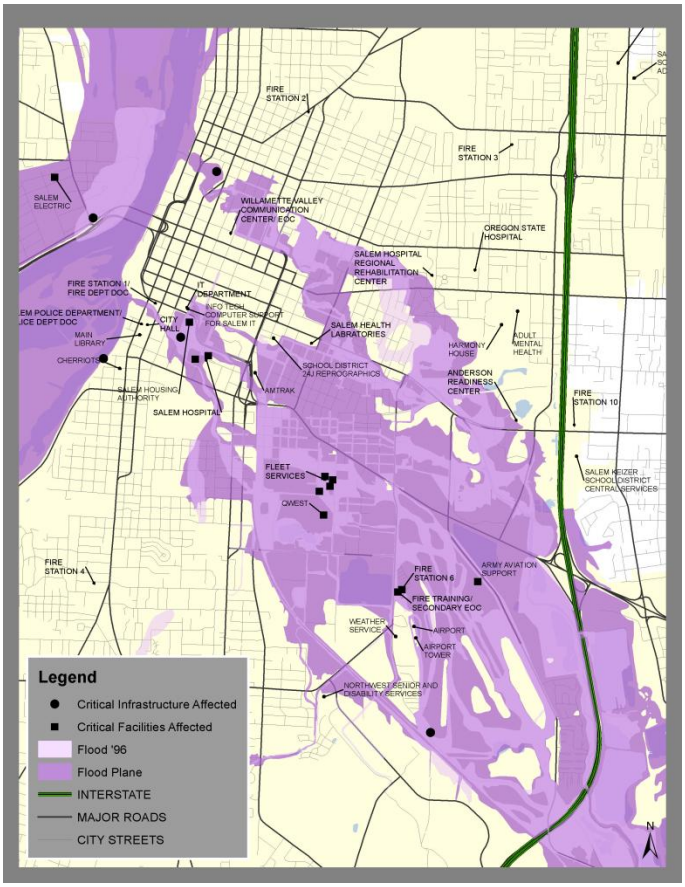
Sometimes the purpose of the facility in question requires that it be located in a hazardous area. Particularly in the case of Salem's wastewater system, critical infrastructure must be located in the floodplain to maintain functionality. However, there are many circumstances where this is not the case, and the function of the facility is not served by its location in a hazard zone. The Salem Civic Center's functionality is put in jeopardy, for example, by being located in a floodplain during a flood event.

Furthermore, Salem should take care to site energy infrastructure in secure areas, particularly if that infrastructure serves a critical facility. For example, even if a fire station is located above the flood plain, it may be inoperable in the event of a flood if its backup generator is located in the flood plain.

2. Rationale:

Currently the City of Salem has thirteen Priority 1 critical facilities and twenty-seven utility links that are located in the hazard areas (see **Figure 6.1**). The public infrastructure and facilities in these hazard areas are more prone to damage than facilities sited out of these areas. For example, the 1996 flood in the City of Salem affected the operations of public infrastructure, including critical facilitates such as the Salem Fleet site and Salem Hospital. These effects of the flood may have been prevented if these facilities were not located in areas that are in, for example, a floodway or floodplain.

FIGURE 6.1 CRITICAL FACILITIES AND INFRASTRUCTURE IN THE FLOOD PLANE



Map by University of Oregon InfoGraphics Lab.

This recommendation is consistent with LEAP Goals I and IV in this chapter, "to *improve the energy security" and "to create a policy environment that fosters long-term investment in energy resilience." It is also in line with Goals 1 and 2 of Salem's NHMP.*

3. Implementation:

Implementation of this recommendation would include the following:

- Adopt this policy into the Salem Revised Code. This addition in the Code will ensure that, when feasible, future construction and development of new City of Salem owned public infrastructure and facilitates will be sited on land that are not within hazard areas.
- Use GIS software and the critical facilities database developed by the UO LEAP team to track future changes in hazard areas and City facility location. This information is important not only for siting future public infrastructure and facilitates out of hazard areas, but also for other planning and mitigation actions.
- Implement the recommendations from the critical facility report and City building audit to ensure that critical facilities are prepared for a variety of natural hazard emergencies, even if those facilitates are in hazard areas.

6.4.2 Streamline Permitting Process for Energy Resilient Projects

1. Overview

As indicated by staff of the City of Salem Community Development Services Department, the process of permitting for renewable energy generation technology should be streamlined to encourage the widespread installation in both private and public facilities throughout the City of Salem.

2. Rationale

Aside from the upfront cost of installation, permitting for renewable energy solutions both on public and private property is one of the major barriers preventing the incorporation of on-site renewable energy generation into current energy strategies. For example, the Pringle Creek Community encountered such problems and spent time and money overcoming the permitting barriers presented by the City of Salem's Revised Code. By addressing renewable energy in a targeted and explicit way in the City Code, Salem can bring down these barriers and create an environment that encourages energy resilient investments by residents and businesses.

This recommendation is consistent with Goals I, II, and IV of this chapter: to improve energy security (by adding redundancy to the traditional grid system), to improve energy independence (by easing access to on-site generation), and to create a regulatory environment that encourages energy resilience. It is also supported by Goal 2 of Salem's Community Energy Strategy, which seeks to "Increase renewable energy used or produced by Salem residents and businesses" by encouraging the installation of solar, hydroelectric, and wind generation technology.

It should also be noted that the issue of permitting for renewable energy generation has become a national issue. House Resolution 2170[104], is designed for "streamlining Federal review to facilitate renewable energy projects" and "cutting red tape" to permit renewable energy opportunities. This highlights both the complexity and ambiguity of current permitting of renewable technologies. The effects of this national discussion will likely be felt at the local level, and may be helpful in Salem's effort to incorporate renewable energy generation technology into its existing infrastructure. Nevertheless, Salem should not wait for federal action to foster renewable energy in the City; any local action Salem takes can only establish Salem as a leader in the field and position the City to take advantage of federal legislation as it occurs.

[104] HR 2170: http://thomas.loc.gov/cgi-bin/query/z?c112:H.R.2170:

3. Implementation

Implementation of this recommendation would include the following:

- Streamline the permitting process for incorporating renewable technology into an existing structure by specifying general requirements in one document. These should include, but not be limited to:
  - Siting
  - Structural Requirements
  - Any additional permits required (i.e. Electrical, plumbing)
  - Inspection Expectations, and
  - Fee Schedule
- Develop an alternative to the traditional permitting process by initiating a Field Issuance Remodel (FIR) inspection model. To execute such a model, this City should:
  - Identify and maintain a list of contractors who are certified to install renewable technology to work directly with a City Building & Safety Department.
  - Develop a field inspector position to pilot this model of inspection, focusing inspection on pre-construction site inspection and troubleshooting issues.
  - This process could expand upon the current "Solarize Salem" program by authorizing and certifying contractors to work under the FIR model.
- Align with efforts of section 6.5.2 of this report in providing a compiled packet including Frequently Asked Questions, contact resources for City-certified contractors, and a checklist of site specification requirements.
  - "The Solarize Guidebook" compiled by the U.S. Department of Energy to promote Energy Efficiency & Renewable Energy, provides a step-by-step process to collectively purchase and permit residential photovoltaic systems. This strategy can be used for permitting and purchasing renewable generation strategies such as wind, hydro, and fuel cell technology.
  - The City of Portland Bureau of Development Services' "Program Guide to Solar Water Heating and Photovoltaic Electric Generators Installed on Commercial Buildings" may also be referenced as a detailed example of incorporating solar energy, in particular, into existing buildings.[105]
- Incorporate permits for renewable technology into permits for new home or commercial construction. The City may also consider offering reduced permitting fee for new construction that incorporates renewable energy into their specifications.
- Make permit applications for incorporating renewable energy into public and private buildings available on the City's Building Permit website (Similar to the permit supplied by Marion County)

[105] http://www.portlandonline.com/bds/index.cfm?a=195360&c=36814

- Appoint a contact at the Building Permit office that deals specifically with renewable energy technology permitting, as each case will likely have site-specific challenges and require Type II Site Plan Review.

6.4.3 Adopt Solar Access Code Provisions

1. Overview

The City of Salem should adopt solar access codes for commercial and residential buildings. These provisions would ensure that property owners are legally able to install and operated solar energy systems, as long as they meet the standards and obligations of the code. Solar energy systems include anything that uses solar radiation for heating, cooling, or electrical energy.

Solar access codes establish a right, under the provisions established in the adopted code, to install and operate a solar energy system at a home or other facility. A jurisdiction that implements solar access provisions ensures that its citizens have access to direct, unobstructed sunlight.

Traditional zoning ordinances and building codes often create problems for solar access. Of particular relevance are regulations relating to:

- Height of buildings;
- Building setbacks from the property line;
- Exterior design restrictions;
- Yard projections;
- Lot directional orientation;
- Lot coverage requirements.

Solar access codes are commonly adopted at the state and local levels of government. Some local governments have incorporated the right to solar access into their city code. Salem can use several policies to protect solar access, including solar access ordinances, development guidelines requiring proper street orientation, zoning ordinances that contain building height restrictions, solar permits.

The most common form of solar access code is solar easements. These statutes provide the opportunity for neighboring property owners (residential and commercial property) to voluntarily negotiate easements between themselves to provide for unobstructed solar access now and into the future. An easement is transferred with the property title. In 1979, the State of Oregon enacted solar easement provisions that allow property owners to create solar easements for the purpose of protecting and maintaining proper access to sunlight.

Solar access codes prohibit homeowners associations, neighborhood covenants and local ordinances from restricting a homeowner's right to use solar energy. Solar easements, the most common form of solar access code, allow for the rights of existing access to a renewable resource on the part of one property owner to be secured from an owner whose property could be developed in such a way as to restrict that resource. An easement is transferred with the property title.

2. Rationale

Currently, the City of Salem development code does not protect the solar access rights of property owners who want to install and operate solar energy systems. Solar energy systems, including photovoltaic systems, are the most common renewable technology and will likely remain a viable renewable technology option for both commercial and residential property owners.

Incorporating solar access provisions into Salem ordinances and codes will help to make the process of installing and operating solar energy technologies in Salem easier. This can encourage more property owners to install solar energy systems, which will increase Salem's energy resilience. The greater the number of solar energy systems in Salem the less dependent Salem is on traditional forms of energy. In an energy disruption, energy independent buildings will recover more quickly than those reliant on non-renewable sources of energy.

The adoption of solar access codes by Salem aligns with LEAP Goals III and IV in this chapter: foster energy independence and create an environment that encourages energy resilient investments.

3. Implementation

Implementation of this recommendation would include the following:

- Incorporate solar access ordinances for both residential and commercial buildings into the Salem City Code.
- Enact development guidelines that require, when capable and feasible, new development to orient buildings in an east-west direction.
- Integrate zoning ordinances that contain building height restrictions.
- Inform property owners with solar energy systems the option of adding a solar easement to their property title.
- Provide an information center, such as a website, that informs property owners, Homeowner's Associations (HOA), developers, contractors, and city officials about Salem's solar access codes, ordinances, and solar easements. (See recommendation 6.5.2 of this chapter.)

6.4.4 Support Implementation of Advanced Metering Technology by Electric Utilities Operating in Salem

1. Overview

The City of Salem should support the implementation of advanced metering technology by electrical utilities operating in Salem. Advanced metering technology, also known as smart meters, is a first step in the development of a "smarter" electrical grid in Salem.

Advanced metering technology does not change the physical infrastructure of the electrical grid, but rather uses technology to more efficiently manage data relating to electrical consumption, distribution, and supply. The technology allows two-way communication to and from the utility company and the customer, providing each with better knowledge.

Advanced metering technology would replace the traditional meters at a customer's home or business. Additionally, advanced electrical meters communicate disruptions in the electrical grid more quickly and accurately than traditional electrical grid systems.

The idea of advanced metering technology is not new to Salem. Portland General Electric, one of Salem's electric providers, is currently conducting a pilot study in Salem to test the use of advanced metering technology, among other smart grid technological systems. The tests location in Salem provides the City with a unique opportunity to support the implementation of advanced metering technology.

2. Rationale

Currently, the City of Salem is using the traditional metering system has its limitations for the future. Salem's future population growth will create a significant increase in electrical demand. The incorporation of advanced metering technology is one way for the utility companies to manage their supply and also give customers reliable data to make informed decisions for times they want to reduce their electrical use and times they want to use more electricity.

Utility modernization by advanced meter technology can provide more stability and quicker recovery during and after an electrical energy disruption than the traditional meter system, making it a more energy resilient system. Furthermore, the utility companies will be able to pinpoint where the disruption occurred and the consumption and supply patterns of the disrupted area to efficiently repower the affected customers.

This recommendation is consistent with LEAP Goals I and IV of this chapter: develop energy systems that reduce vulnerability to disruptions and create an environment that encourages energy resilient investments.

3. Implementation

Implementation of this recommendation would include the following:

The following strategies provide the support that local utilities need to implement advanced metering technologies, but also move toward the implementation of other smart grid technologies.

- Develop frequent communication with local electrical utilities about advanced metering technologies.
- Collect and continually update best practices and new metering technologies to share with local utility companies and city staff.
- Provide an information center, such as a website or appoint a contact at the City of Salem that informs Salem residents, city staff, and local utility companies about smart grid technologies, financial incentives, and general information about the benefits of modernizing the utility infrastructure.

6.4.5 Localize Energy Production and Storage

1. Overview

Salem should identify areas within the City that are at particular risk to disruptions in their energy supply in the case of an emergency event, and work to increase the energy independence of these areas through improved energy generation and storage capacity.

Establishment of these "energy independence zones" will focus on areas that: rely on vulnerable life lines and supply connections, are far-flung and likely to experience longer-than-average down times in an energy emergency, and would otherwise benefit from more localized energy supply and generation.

Once the zones have been identified, various actions should be taken to improve the energy independence of the zones. Short-term actions should focus on improving the storage and generation capacity of existing forms of energy with more back-up generators and fuel depots. Longer-term actions will seek to transform the energy system in these areas with local renewable energy generation. The ultimate goal should be for the different regions of Salem to be fully energy-independent in an emergency event, requiring little or no outside inputs in order perform critical functions.

2. Rationale

Not only is Salem as a whole at risk from energy supply disruptions, but access to energy and critical services is not distributed evenly within Salem. Some areas of the City are farther from supply centers than others, rely on vulnerable life lines or supply connections, or are "off the beaten path" and will likely see longer down times in an energy emergency.

West Salem is a good example, as many of its lifelines and infrastructure connections cross the Willamette River and are vulnerable to being cut off during an earthquake,

flood, or other event. West Salem will likely see longer down time in an energy emergency, so it may need greater access to fuel stores in order to weather such an event.

If the ultimate goal of this recommendation is achieved, each area of Salem will be able to weather an event of almost indefinite length, because each area will have the energy generation, fuel storage, and emergency response capacity to respond locally to an event.

This recommendation is in line with LEAP Goals I and III of this chapter: energy independence and energy security. This recommendation also supports Goal 2 of Salem's Community Energy Strategy and Goal 2 of the NHMP.

3. Implementation

Implementation of this recommendation would include the following:

Salem should start by identifying high-priority areas at risk of isolation in the case of an emergency event. The specific energy resilience strategies will vary depending on the unique characteristics of each area, but some possibilities include:

- Decentralize petroleum fuel storage so that all critical facilities are within a minimum distance of a fuel storage depot. Use GIS software to identify ideal locations for fuel storage points to effectively serve the most critical facilities.
- Build relationships with private fuel suppliers for emergency access to their storage in the event of an energy interruption.
- Where feasible, site public facilities and infrastructure near one another to efficiently share energy resources. If a sufficient number of facilities can be sited in one campus a "district energy" arrangement may be possible, in which electricity and heat are generated in a shared mid-size facility.
- Work with utilities and local building owners to create clusters of renewable energy generation in areas surrounding critical facilities. Link the generation capacity to the facilities using smart grid technology such that the electricity can be used by private consumers during normal times but switch to supply critical facilities during emergency events.

6.5 Planning and Zoning for Energy Resilience

Disaster resilience can be a catalyst that encourages Salem to promote sustainable development practices into traditional planning and development functions. Across the country, local governments are developing or updating their policies and regulations for small wind, solar, or other renewable facilities. Some jurisdictions have developed model alternative energy facility ordinances. The following are adjustments the City of Salem should consider.

6.5.1 Comprehensive Planning

1. Overview

Salem should consider including a vision for alternative energy into their Comprehensive Plan.

2. Rationale

Energy underpins nearly all functions of the City of Salem. Consequently, City operations have an indisputable reliance on energy inputs of all forms. In order to make energy assurance a pillar of Salem's future, inclusion of energy-related goals and action items within a comprehensive planning framework would ensure community awareness of evolving energy assurance over the twenty-year planning horizon. With the inclusion of energy resilience in their Comprehensive Plan, Salem can achieve incremental improvements in energy assurance as normal maintenance occurs. Ultimately, consideration for energy resilience will become a behavioral and cultural norm amongst the community at-large.

3. Implementation

Implementation of this recommendation would consist of inclusion of energy assurance in Salem's next Comprehensive Plan Revision in the following capacities:

- Clear vision statements about energy independence over the next planning horizon.
- Goals for community resources to achieve with respect to energy efficiency
- Implementation strategies consistent with these goals providing opportunities for community leadership to steward energy resilience at district, neighborhood, business, and household levels.
- Action items to be executed by City Staff regarding energy assurance within each department of Salem.

6.5.2 Salem Revised Code

Salem should create a Chapter within the Salem Revised Code addressing the emergence, installation, and integration of renewable technologies into the energy scheme of the City. With a rapidly-growing market of micro-sized renewable technologies, the City as a whole would benefit greatly from their integration into both public and private buildings. In regards to energy resilience, the presence of localized, on-site renewable energy generation power would provide a stand-alone energy source in the event of a power interruption of any kind. Such energy independence could allow city facilities, as well as private endeavors, to continue and help the community recover from an energy interruption.

By defining the parameters for design, installation, and building relationships with local energy providers (PGE and Salem Electric), residents of Salem will be able to make educated and safe decisions when choosing to integrate renewable technology into their home or business.

1. **Rationale**

The Salem Revised Code (SRC) does not adequately address the issue of renewable technology. Though referred to in SRC 130 as an "exception," in order for the permitting process and other components recommended in this document to succeed, it is imperative that Salem take the necessary steps to not only encourage the use of renewables, but gain enough knowledge to develop a chapter within the SRC to address this issue.

This recommendation follows LEAP Goals I, III, and IV of this chapter: assuring residents of Salem that these devices and forthcoming energy strategies will be safely and properly installed, guaranteeing energy security through on-site generation, and normalizing the use of renewable technologies by planning for their incorporation into everyday energy strategies.

2. **Implementation**

The UO CSC recommends Salem take a systematic approach to developing a chapter of this nature for the SRC. Using the many resources available to the public regarding the various renewable technologies that exist (See Technical Appendix III), a chapter can be developed addressing the following issues (as they apply):

- Building & Safety structural concerns
- Electrical permitting
- Mechanical review
- Height requirements and restrictions

By allocating time from selected City Staff to do required research on the existing technologies, Salem can develop an educated Chapter to address the changing energy choices available to consumers today.

6.5.3 Facilitate Public Access to Energy Information

1. **Overview**

Salem should conduct a public campaign to raise awareness about energy assurance. The City's educational efforts should include, but not be limited to:

- Promoting energy savings programs, launching an educational campaign to alter behaviors about energy use, and working with utilities to enact energy demand management measures;
- Improving transparency and allowing greater public access to information about Salem's energy use;
- Developing a website to serve as a clearinghouse of information about energy programs, projects, policy, and incentives, including a library of energy resources for businesses and residents that is regularly updated;
- Providing guidebook reference manuals for permitting renewable energy generation;
- Supporting local residents and businesses in energy resilience efforts.

2. Rationale

To achieve energy resilience throughout the Community, every citizen and business needs to do their part to reduce consumption and improve efficiency and independence of energy. A better educated public will be more likely to support investments in energy resilience, take actions to improve the energy resilience of their own homes and businesses, and will be better prepared in the event of an energy emergency.

This recommendation is consistent with LEAP Goals II and IV in this chapter: decrease total energy consumption and foster a culture that makes long-term investments in energy resilience. This recommendation also supports Goals 1 and 5 of the Salem Community Energy Strategy, and can be aligned with Multi-Hazard Action 5 of the NHMP: "Develop public outreach materials for all natural hazard risks addressed in the Salem Natural Hazards Mitigation Plan. Educational materials should include mitigation actions residents and businesses can implement to reduce their risk to natural hazards, and there they can obtain more detailed natural hazard information."[106]

3. Implementation

Implementation of this recommendation would include the following:

- Develop a website to serve as a clearinghouse of information about energy information.
- Enhance public understanding of the economic and environmental benefits of energy efficiency investments.
- Support local residents and businesses in energy resilience efforts with an online library of local resources for people wishing to invest in energy efficiency and on-site generation.
- Make City energy use data publicly available online by posting monthly energy bills on the City's website. As City facilities begin to install Energy Hawk monitoring systems, this data can become real-time and facility-specific. Providing comparisons to previous years' data will allow the City to demonstrate the benefits of its energy efficiency upgrades.
- Partner with utilities to provide education and information to residents regarding natural hazards that could cause local disruptions in the energy supply, such as landslide areas, overhanging trees, and flood plain areas. Encourage residents and developers to avoid such areas when siting buildings and energy infrastructure and to be proactive in dealing with hazardous tree limbs and other threats to the energy system.
- Work with utilities to enact energy demand management measures. Focus on low-cost energy demand reduction strategies such as including information in utility bills comparing residents' consumption levels to their neighbors'.

[106] University of Oregon Community Service Center, *City of Salem Natural Hazard Mitigation Plan* (Salem, OR: City of Salem, 2008).

- Partner with a variety of local players to help ensure broad support for these outreach efforts, including the local Chamber of Commerce, Business Associations, Homebuilders Associations, Salem-Keizer Schools, utility companies, and other organizations.

6.6 EMERGENCY RESPONSE AND MANAGEMENT RECOMMENDATIONS [LEAP GOAL V]

6.6.1 LEAP Goal V -- Enhanced Emergency Response to Energy Disruptions

LEAP Goal V of this Report seeks to enhance the efficiency and effectiveness of emergency response to energy disruptions. The following recommendations are intended to implement this goal.

6.6.2 November 2009 City of Salem Revised Code (SRC): Chapter 2.6 Emergency Management

1. Overview

Chapter 2.6 of the City of Salem Municipal Code establishes the legal authority for emergency management and services within the City. Sections 2.660 – 2.680 set forth the legal authority for emergency management within the City. Section 3.1.3 in Chapter 3 of this LEAP Report reviews Chapter 2.6 (Emergency Management) of the November 2009 City of Salem Revised Code (SRC), which includes in subsection SRC 2.680 (Emergency Orders) the emergency powers that the City can evoke in a declared emergency.

2. Rationale

On November 19, 2010, members of the UO CSC LEAP Team met with the Salem Emergency Preparedness Manager (EPM) to assess the efficacy of the City's legal authority in emergency situations. The EPM indicated that the City's long standing broad interpretation of the above SRC sections, particularly 2.680(7), have worked well for the City. Accordingly, no changes are warranted at this time.

6.6.3 Updating the Salem Emergency Management Plan (SEMP)

1. Overview

The December 2006 Salem Emergency Management Plan (SEMP) embodies the legal emergency management authority in a pragmatic operational framework designed to cover all hazards and all phases of emergency management. The SEMP is designed to be in compliance with national emergency management policies [e.g., National Incident Management System (NIMS) and US Department of Homeland Security mandates], and ORS Chapter 401, as well as the Salem Revised Code. Section 3.1.4 in Chapter 3 of this LEAP Report reviews this December 2006 Salem Emergency Management Plan (SEMP)

2. Rationale

The City indicates that it is in the early stages of updating its SEMP. The normal periodic update process of the SEMP is an excellent opportunity to incorporate key elements of this LEAP Report.

3. Implementation

Implementation of recommendations intended to further LEAP Goal V (enhance the efficiency and effectiveness of emergency response to energy disruptions) would include the following:

- **Energy Emergency Related Definitions:** CSC recommends that, among other considerations, the critical facilities and infrastructure definitions and related energy assurance terminology used in this LEAP document and its appendices be incorporated into the revised SEMP.
- **Current Salem Revised Code References:** In reviewing the 2006 SEMP it was noted that an older version of the Salem Revised Code (SRC) is cited and does not (obviously) include citations from the 2009 SRC. CSC recommends that during the update process, the City incorporate current SRC references.
- **Compliance with Federal and State Mandates:** Throughout the SEMP update process, CSC recommends that the City continue to be in compliance with current National Incident Management System (NIMS), US Department of Homeland Security, Federal Emergency Management Agency (FEMA), and Oregon Emergency Management (OEM) mandates, standards and requirements. Such compliance is crucial at several different levels. First and foremost, is smooth, efficient and timely cooperation between different levels of government during disasters and emergencies – the wellbeing and safety of the public and the built environment may be at stake. Secondly, funding from federal and state sources for a variety of emergency management needs – pre and post disaster – may be at stake, if not currently then in the future as rules change.
- **Enhanced Communication and Decision-Making During Energy Related Emergency Events:** Section 3.2 in Chapter 3 of this LEAP Report reviews the "Existing Pattern and System of Authority and Response During Power Disruptions." This review included a look at how the City currently interacts with energy utilities during emergencies, monitoring energy flow to critical facilities and infrastructure, and the Standard Operating Procedures (SOPs) of the City's Facilities Services Buildings for energy disruptions. The sources for this information included the City's (1) Emergency Preparedness Manger, (2) Strategic Planning Section Senior Utilities Planning Project Manager (Public Works Department), and (3) the Facilities Services Division. CSC recommends that all of these City efforts could be even more effective with enhanced, systematic communication and decision making during energy related emergency events. Section 6.6.4 below recommends the immediate adoption of an energy assurance annex to the current and the updated SEMP.

6.6.4 Salem Emergency Management Plan Annex Y -- Energy Emergencies and the Energy Assurance Plan Advisory Group

1. Overview

The UO CSC LEAP Team, in cooperation with Salem's LEAP Resource Group (including key City staff), have developed and refined (based on the results of an October 5, 2011 Table Top exercise) an Annex for the City's Emergency Management Plan (SEMP) that focuses on enhanced communication and decision-making between the public and private sector during energy disruptions. This annex is currently designated **Annex Y** based on the current format and content of the 2006 SEMP.

This Annex draws upon the LEAP Plan identification of critical facilities and infrastructure and establishes communication protocols, actions and priorities by which critical facilities and infrastructure will be re-energized after a disruption.

During an emergency event, this Annex provides for the activation of an Energy Assurance Advisory Group and an Energy Assurance Liaison Officer. The City's Incident Commander is thus able to draw upon the expertise of professionals in the field of energy provision to ensure that secure supplies of energy will be restored to priority critical facilities and infrastructure as well as the community in general in a timely fashion, depending on the overall emergency situation.

This Annex contains the following elements:

I. Purpose Statement
II. Situation Statement (including an overview of the types of threats and hazards the community could face, based on Chapter 5of this LEAP Report).
III. Concept of Operations (including a Roster template for members of the Energy Assurance Advisory Group, and placement in the ICS organization of the City when the EOC is operational).
IV. Procedures (including communication guidelines, subsections on non-City energy suppliers and distributers, state agencies, and City departments).
V. Energy Emergency Incident Levels (including general guidelines, State authority, severity of incident levels and City response levels).
VI. Appendices: Communication Matrix including contact names and means of communication, and notification protocols; Priority Critical facilities and Infrastructure – Matrices and GIS maps – from the LEAP Report; City's Energy Risk Assessment from the LEAP Report).

2. Rationale

The current SEMP does not have an annex devoted specifically to handling energy emergencies.

3. **Implementation – Adopt Annex Y.**

   Implementation of recommendations intended to further LEAP Goal V (enhance the efficiency and effectiveness of emergency response to energy disruptions) would include the following:

   1. Adopted immediately Annex Y as part of the current SEMP. The importance of responding effectively and in a timely fashion to energy emergencies is too great to wait on a full overhaul and update of the 2006 SEMP.
   2. Include an enhanced version of Annex Y when the 2006 SEMP is updated.

6.7 CONCLUSIONS

6.7.1 Emergency Management Mitigation and Preparedness Phases

Ultimately, integrating mitigation and preparedness concepts and strategies (LEAP Goals I-IV and the related recommendations above) into City's code will, in the long run, have several major results. These would include a greater and more permanent "institutionalization" of hazard mitigation and preparedness into the City's development processes, practices, and pattern. The opportunities for effectuating desirable change and improvement to the City's development pattern and community support systems will be greatly enhanced.

6.7.2 Emergency Management Response Phase

Implementation of the Emergency Response recommendations noted above in Section 6.6 will help the City achieve LEAP Goal V: Enhance the efficiency and effectiveness of emergency response to energy disruptions.

6.7.3 Emergency Management Recovery Phase

Implementation of the above noted recommendations and the City's efforts to achieve the related Mitigation, Preparedness, and Response Goals with also expedite the City's recovery efforts from emergency events, especially energy disruptions. Therefore, the entire community – the public sector, the businesses and citizens in general -- all benefit in the long run from less severe damage, shorter periods of disruption, loss of vital functions and commercial activity, as well as lower threats to health, welfare and safety.

6.7.4 Systemic-level Considerations: Facilities and Infrastructure

Integrating the aforementioned recommendations will help to shape Salem's approach to systemic efficiencies, adding a long-term component to existing efforts towards energy resilience. Understanding the need for improved asset management strategies as it relates to energy dependency, it is important to recognize the relationships of utility links to their systems, especially as they relate to critical facilities.

TECHNICAL APPENDIX III: ALTERNATIVE ENERGY TECHNOLOGY

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