Reducing Energy Demand and Supporting Alternative Energy

A Discussion Paper about Community Resilience *November 2015*

Brief: *Society uses energy in every aspect of daily life. We power our homes, businesses and industry with electricity and natural gas. Modern forms of transportation use vast quantities of primarily oil-derived products to move people, goods and services. The operation and security of our communication systems are dependent upon the reliable delivery of sufficient energy. Yet the increasing use of carbon-based energy systems is directly causing changes in the climate on a global scale that threatens both the human race and the ecosystems surrounding us.*

Problem/Observations

From the beginning of time the use of energy has been a key in the development of human society. Managing the use of energy is a pre-requisite for society to continue to function and evolve. In the industrialized world the development of energy resources has become essential for agricultural production, transportation, heating and lighting our homes, businesses and industry operations, information technology and communications.

Energy policy at the local and state level can and should be directed at the development and use of all forms of energy in an increasingly efficient manner aimed primarily at reducing overall consumption and limiting the contributions and effects to climate change. State and local energy policies may include legislation, incentives to investment, guidelines and tools for energy conservation, and other public policy techniques including multimodal transportation and urban planning and zoning modifications.

The major energy sources consumed in the US are oil (petroleum) and its byproducts, primarily gasoline, diesel, and aviation fuels; natural gas; coal; nuclear and renewable energy (wind, solar and hydro*). Major energy uses are residential and commercial buildings, industry, transportation and electric power generation. The pattern of energy use varies widely by sector. For example, oil provides 92% of the energy used for transportation, but only about 1% of the energy used to generate electric power.

Wind Turbines, Eastern WA, Photo courtesy of Dee Caputo

The national average fuel economy for autos and light trucks has improved over time mainly because of fuel economy

standards set by the federal government for those types of vehicles. Also contributing is the emergence of alternative energy sources, including hybrid and all electric vehicles. However, total transportation fuel consumption has generally increased because of the increase in the overall number of vehicles, especially light duty pickup trucks, sport utility vehicles and heavy duty freight vehicles. Fuel consumption has generally increased because of the number of miles traveled per vehicle.

Personal vehicles consume more than 60% of the energy used for transportation. The US, with less than 5% of the world population, is home to 1/3 of all the automobiles on the planet.

In 2007, automobiles, motorcycles, trucks and buses drove nearly 3 trillion miles in the US-about the equivalent of driving to the sun and back 13,440 times. Over the next 20 years, the total number of miles driven by Americans is projected to grow by about 40%, increasing the demand for fuel, and the total volume of greenhouse gas emissions significantly without significant reversals in current trends.

Opportunities to reduce greenhouse gas emissions related to transportation include fuel switching, improving fuel efficiencies, improving operating practices and reducing travel demand. Fuel switching includes: 1) utilizing less carbon intensity fuels such as compressed natural gas for buses and daily trip based freight and package delivery operations, and 2) using electric and hybrid vehicles – as long as the electric generation is provided by lower carbon (natural gas) or renewable sources.

Improving fuel efficiencies is primarily driven by incorporating advanced technology, design and materials to develop vehicles with improved fuel efficiencies. Improving operating practices includes adopting standards that require less vehicle idling, and encourage sensible driving techniques, which includes efficient transportation movement through effective signalization programing. Reducing travel demand includes optimizing public transportation, building sidewalks and bike lanes to increase the use of lower carbon emission transportation choices, and focused mixed use zoning for residential, educational and business uses to locate them sufficiently close to reduce the need for driving.

Smart growth and mobility management programs provide the best opportunities for local planners to implement strategies to reduce transportation dependencies and related greenhouse gas emissions. See the discussion briefs on Creating Compact Communities and on Mobility.

There is a general trend away from the reliance on coal for electric power generation in the US. This trend is being driven primarily by federal regulations addressing greenhouse gases and other air pollutant emissions. Natural gas and renewable energy sources have increased their role in producing the US electricity supply. Today renewable resources generate about 13% of the electricity supply in the US. Additionally, nuclear energy accounts for approximately 22% of the energy used to generate electricity in the US.

Washington is blessed with abundant hydropower generation capacity,

supplying an overwhelming majority of the electrical needs of the state and significantly contributing electrical supply on a regional basis when excess generation capacity exceeds demand. However, this resource is threatened by effects of climate change including warmer winter temperatures and less precipitation which combines to reduce snow pack in the mountain ranges surrounding the Columbia River basin.

Much of the energy the US consumes is lost or wasted through transmission, heat loss and inefficient technology, which costs individuals, consumers and businesses money, and leads to increased carbon pollution. Energy efficiency is one of the easiest and most cost effective solutions to combat climate change, improve the competitiveness of our commercial and manufacturing sectors, and reduce energy costs for consumers. Governmental agencies, universities and businesses are working to develop new, energy efficient technologies while boosting the efficiencies of current technologies on the market.

**for the purposes of this discussion hydropower generation will be considered a renewable resource even though it is not counted in Washington towards the Renewable Portfolio Standard for electric energy production.*

Rock Island Dam, Columbia River, Washington

For more than 20 years, building energy codes have been cost effectively improving the energy efficiency of residential, commercial and industrial structures. These efficiencies also provide local, regional and national energy, environmental and economic benefits. Building energy codes set minimum efficiency requirements for new construction and renovation of existing structures, which provide energy savings and related environmental benefits.

The state of Washington has promulgated the 2012 International Energy Conservation Code, developed by the Department of Energy. Local building officials adopt this code into the local building codes. A handful of states are early adopters of the 2015 IECC addition. These updates provide significant energy-related savings to residential and commercial developments relative to previous versions. Washington state and local building officials should be encouraged to adopt the 2015 revisions a reasonable timeline.

The retrofit of energy systems in existing residential, commercial and industrial facilities provide also provide significant benefits in reducing energy use and long term reduction in operating costs. Local planners can seek opportunities to partner with local energy providers, contractors and developers to conduct energy audits of existing structures.

These audits will identify opportunities to increase energy efficiency, including weatherization (window upgrades and increasing insulation), rebate incentives for more efficient lighting and appliances, and modifications of commercial and

industrial processes for energy use reductions and efficiencies.

Project Example

Bellingham's Environmental Learning Center

In 2007 the U.S. Environmental Protection Agency (EPA) named the City of Bellingham its Green Power Partner of the Year, providing national recognition of Bellingham's effort to promote renewable energy. Through collaborative efforts with the non-profit Sustainable Connections, as well as Puget Sound Energy (PSE), the Bellingham community doubled it green power purchases and quadrupled its goal of raising 9,000 MWH of green power. In addition, the City of Bellingham and Whatcom County governments began purchasing 100 percent green energy from PSE.

Building upon the city's visionary efforts, Puget Sound Energy funded the installation of a 2040-watt solar energy system on Bellingham's Environmental Learning Center at Maritime Heritage Park; the center will continue to raise awareness of renewable energy. EPA's Green Power Partnership is a voluntary program that supports the organizational purchasing of green power by offering technical support and resources. EPA also works with local governments and businesses to lower the transaction costs of buying green power, reduce its carbon footprint, and communicate its leadership to key stakeholders.

Strategies for Local Planners

Solar Opportunities

Many communities in Washington already recognize the environmental and economic benefits of local solar energy. A primary key to successful local solar market development is a regulatory environment that encourages traditional and innovative solar resource development. Planners can encourage the expansion of solar energy use by examining local zoning and building codes regulating bulk dimension requirements, height limits and height exceptions for rooftop solar, and by modifying said codes to address small-scale distributed generation. If codes contain prohibitive language discouraging this type of development, they can be modified to optimize these resources while continuing to maintain community values. If local codes are silent, they can be amended to support and encourage local development of distributive generation resources.

Project Examples

(see next page)

Solar panels on Sakai Intermediate School in Bainbridge, WA

Community Energy Solutions, a non-profit on Bainbridge Island, installed a 5.1 kilowatt solar array on the Bainbridge Sakai Intermediate School. The project benefited from the Solar4RSchools program through Bonneville Power Administration, using community outreach to raise the additional $30,000 for the panels in less than 3 months. http://nwcommunityenergy.org/solar/solar-case-studies/copy2_of_the-vineyard-energy-project

Ellensburg Community Solar Project

Another energy example is the community solar project in Ellensburg, Washington – *a partnership with the City of Ellensburg and the Bonneville Environmental Foundation. In 2006 the city installed a solar system supported through an innovative and unique financing approach—individuals and businesses making financial contributions are given direct credit on their electricity bills for the green power produced.* https://www.google.com/search?q=Ellensburg+solar+schools&ie=utf-8&oe=utf-8

Streamlined permitting can also be very useful for encouraging solar energy development, providing guidance to solar installers on regulations, requirements and costs up front. Some cities have even waived building permits for residential solar installations meeting basic fire access, and solar and wind load requirements, merely requiring an electrical permit – for more information, see Northwest Solar Communities. http://nwsolarcommunities.org/

Note that some Homeowner Associations (HOAs) resist solar installations for design and aesthetic reasons. Planners may need to devote time to becoming familiar with HOA requirements, and then provide information to HOAs on solar impacts. State law (RCW 64.38.055) disallows the HOA from prohibiting solar installations, but does allow the HOA to regulate some design qualities of solar installations. HOA staff may cite homeowner concerns with aesthetics, or that solar negatively impacts home values.

Research has shown that Solar installations can improve the resale value of a home by $15,000 -$20,000 (or about $4 a watt), depending on installation size; for more information, see the Lawrence Berkeley Laboratory study, Selling into the Sun, drawing conclusions from a

study of 22,000 homes across eight states from over a decade of sales histories. https://emp.lbl.gov/sites/all/files/selling-into-the-sun-jan12.pdf

Lastly, there are various programs planners may undertake in concert with citizen groups to provide alternative purchasing solutions, including Solarize campaigns and Community Solar Campaigns.

Solarize is a group purchase or "bulk buy" program for solar panels, where citizens and a non-profit jointly select a single installer for a large number of installations, who in return for the large number of installations (25-40 installations per campaign on average), offers a discount of 5-10%. With various incentives, including the Federal Tax Credit of 30% of system costs (expiring 2016) and the Washington State Production Incentive (5%-10% of installation cost per year until 2020), the return on investment on small solar installations can be 7-8 years. Cities such as Seattle, Bellevue, Kirkland, Mercer Island and Snoqualmie have run such campaigns in Washington State.

Another alternative is a Community Solar program, where several individuals pool funds to develop solar off-site on publically-owned land, and in return receive "shares" of the incentives associated with the solar installation. For more information, see some of the publications developed by Northwest SEED on these programs. http://www.nwseed.org/education/publications/

The following links provide resources on solar energy for local planners to consider. These resources address evaluation of large solar energy proposals; provide community solar and solarize project information; and offer guidance for integrating solar opportunities into local regulations.

Planning for Solar Energy Briefing Papers
(APA) www.planning.org/research/solar/briefingpapers/pdf/solarpaperscompendium.pdf

Integrating Solar Energy into Local Development Regulations
(APA) www.planning.org/research/solar/briefingpapers/localdevelopmentregulations.htm

Northwest Solar Communities
http://nwsolarcommunities.org/

Chen, Allan. "Berkeley Lab Illuminates Price Premiums for U.S. Solar Home Sales," Berkeley Lab News Center, 01/13/15. http://newscenter.lbl.gov/2015/01/13/berkeley-lab-illuminates-price-premiums-u-s-solar-home-sales/

Northwest SEED Publications
www.nwseed.org/education/publications/

Green Building Systems

Through adoption of stringent building code requirements, local planners can influence the construction of new buildings and the retrofit of existing buildings. The APA partners with the US Green Building Council to develop and provide educational opportunities in the design and construction of LEED certified facilities. Information available to assist the local planner for LEED construction techniques and certification requirements is available at: www.usgbc.org/leed

Additional Green Building systems may also be worthwhile to explore, such as Built Green – planners may even advocate in planned unit developments that developers provide a certain number of residences certified to Built Green Standards; www.builtgreen.net/.

The City of Seattle helped encourage development of the Bullitt Center, meeting Living Building Challenge, possibly the world's most strict green building standard. This building is the first certified Living Building, with the Living Building Pilot.

Bullitt Center Photo by Lloyd Alter

The opportunity to upgrade existing buildings and structures to become more energy efficient is an important consideration for sustainability in certain circumstances. Local planners can be strong advocates for preserving the character of established neighborhoods while encouraging the investment in energy efficiencies into existing structures. Planning Departments may even consider commercial energy benchmarking programs to help large commercial entities comply with state disclosure laws on energy use, or working with their utility (or, finance departments) to run or fund a local residential retrofit program to help citizens save on energy costs.

Resources available to the local planners for energy efficiency and sustainability of existing facilities are described in the Encouraging Green Building Practices discussion brief.

Other resources include:

DOE Retrofit Existing Buildings
http://energy.gov/eere/buildings/retrofit-existing-buildings

Retrofitting Existing Buildings to Improve Sustainability and Energy Performance
www.wbdg.org/resources/retro_sustperf.php

Living Building Challenge
http://living-future.org/lbc

Commercial Energy Benchmarking Resources (IMT: the Institute for Market Transformation)
www.imt.org/policy/building-energy-performance-policy

WA Energy Benchmarking Law
www.buildingrating.org/jurisdiction/Washington

Transportation Planning

Local planners have the opportunity to lead the discussion on focused transportation planning. Efficiently moving people, goods and services with systems that reduce the dependency on carbon-based fuels will reduce greenhouse gas emissions, provide sustainable communities and encourage responsible growth.

Planners can contribute by coordinating with regional transportation providers, encouraging carpool programs, working

with fleet managers to purchase low-and no-carbon vehicle, installing electric vehicle charging stations – and even requiring commercial and multifamily construction to be EV-ready. These are all great ways to support more efficient, cleaner energy use in our transportation systems.

Ahead of the Curve is a comprehensive transportation planning document developed by the Transportation Division of the American Planning Association. That document provides significant resources for the local planner and can be found at: www.planning.org/divisions/transportation/report/pdf/aheadofthecurve.pdf

Smart Grid

The Smart Grid is slowly moving the energy industry into a new era of reliability, availability, and efficiency. During the transition period, it will be critical to carry out testing, technology improvements, consumer education, development of standards and regulations, and information sharing between projects to ensure that the benefits envisioned from the Smart Grid become a reality. The benefits associated with the Smart Grid include:

- More efficient transmission of electricity
- Quicker restoration of electricity after power disturbances
- Reduced operations and management costs for utilities, and ultimately lower power costs for consumers
- Reduced peak demand, which will also help lower electricity rates
- Increased integration of large-scale renewable energy systems
- Better integration of customer-owner power generation systems, including renewable energy systems
- Improved security

The Smart Grid is not just about utilities and technologies; it is about giving consumers the information and tools needed to make choices about energy use.

The Smart Grid will consist of millions of pieces and parts—controls, computers, power lines, and new technologies and equipment. The Smart Grid has the potential to significantly transform how society uses electrical energy.

Local planners can encourage the integration of smart grid technologies by working with local utility providers as they design and construct new electric systems to accommodate growth.
To learn more about smart grid go to: http://energy.gov/oe/services/technology-development/smart-grid

Distributed Generation

Distributed generation (DG), is the use of small-scale power generation technologies located close to the customers being served. The DG marketplace includes energy companies, equipment suppliers, regulators, energy users and financial and supporting companies. For some facilities, DG can lower costs, improve reliability, reduce emissions, or expand energy options. DG may also add redundancy that increases grid security. Facilities can also recover and utilize heat from their DG systems, a practice known as combined heat and power.

The portfolio of DG technologies includes reciprocating engines, microturbines, combustion turbines, small steam

turbines, fuel cells, photovoltaics, and wind turbines. Each technology has varying characteristics and emission levels.

DG is currently being used by some customers to provide all or portions of their electricity needs. There are many different potential applications for DG technologies. For example, some customers use DG to reduce demand charges imposed by their electric utility, while others use it to provide premium power or reduce environmental emissions. DG can also be used by electric utilities to enhance their distribution systems.

Most traditional DG is interconnected to the grid. The electric power system was designed to produce electricity at large power plants in remote locations, send it over high-voltage transmission lines, and deliver it on lower-voltage utility distribution systems to customers. Increasingly, electricity is produced by smaller, cleaner distributed generation units at or near customer sites and connected back to the utility distribution system. The traditional one-way power flow – from power plants to customers – is turning into a two-way street.

Local planners can assist in the evolution of distributed generation as existing and new technologies such as fuel cells, solar and wind turbine systems and combined local heat/power generation facilities may become a consideration within their jurisdiction. To learn more about distributed generation, go to: http://energy.gov/oe/technology-development/smart-grid/distributed-energy

Demand Side Management

Demand-side management (DSM) programs consist of the planning, implementing, and monitoring activities by electric utilities which are designed to encourage consumers to modify their level and pattern of electricity usage.

In the past, the primary objective of most DSM programs was to provide cost-effective energy and capacity resources to help defer the need for new sources of power, including generating facilities, power purchases, and transmission and distribution capacity additions. However, due to changes that are occurring within the industry, electric utilities are also using DSM as a way to enhance customer service.

Additional Resources

Washington State Dept. of Commerce, Growth Management Services, Energy Aware Communities webpage: www.commerce.wa.gov/Services/localgovernment/GrowthManagement/Growth-Management-Planning-Topics/Climate-Change-and-Energy/Pages/Energy-Aware-Communities.aspx

Washington State Energy Office http://www.commerce.wa.gov/Programs/Energy/Office/Pages/default.aspx