

Appendix 7

RESOURCE OPTIONS

An essential mission for integrated resource planning is to identify and evaluate a broad range of resources, as required by Washington law (RCW 19.280), including conservation.

This appendix contains information about resources currently available to electric utilities and considered for the 2012 Integrated Resource Plan (IRP). These include additional conservation resources; nonrenewable generation resources (natural gas); renewable generation resources (wind, geothermal, biomass, and landfill gas); hydro efficiency improvements; power purchase contracts; and short-term power purchases from the Western wholesale energy market.

CONSERVATION RESOURCE

Conservation is City Light's first choice as a resource to meet growing demand for power. Through its conservation programs, City Light partners with its customers to use energy-efficient equipment and practices in homes and buildings. Investment in conservation is advantageous for the utility and its customers, and delivers other benefits as well, such as avoided higher-cost generation, deferred transmission and distribution investments, and reduced air pollution and greenhouse gas emissions. As a low-cost, low-carbon alternative to other types of energy generation, conservation is the foundation of City Light's plan to meet the requirements of Initiative 937 (I-937). Acquiring conservation is also a good policy in a transforming energy market because it avoids price risk and availability risk. City Light has provided conservation programs for over 30 years.

Characteristics

Utilities must be able to match resources to load. Dispatchability refers to a utility's ability to control the output of a generation resource in real time. More readily controlled resources, such as simple-cycle combustion turbines, have a greater degree of dispatchability. Energy efficiency measures are not dispatchable.

Conservation resources have seasonal, daily and hourly load shapes. An energy-efficient water heater saves more energy in the morning than other times of the day, because hot water use is greatest in the morning. An energy-efficient window installed in a home with electric heat will save more energy in the winter, when heating is used the most.

Conservation measures can be either discretionary or lost opportunity resources. Discretionary conservation measures can be implemented at any time within practical limits. Discretionary conservation usually involves ad hoc energy efficiency improvements by an existing City Light customer,

whereas lost opportunity conservation must be captured when a new building is built or when a new appliance is installed; if not, the conservation benefit can be lost. If energy efficient lamps and fixtures are not installed in a new building at the time of construction, the potential for energy savings and operational efficiency is lost until the building is replaced or retrofitted in the future at a much higher cost.

Conservation Potential Assessment

The Conservation Potential Assessment (CPA), conducted by energy analysis firm Global Energy Partners in 2011, examined available energy savings in the residential, commercial and industrial sectors in City Light's service area. It considered hundreds of potential conservation measures, distinguishing between discretionary and lost opportunity resources. The study also incorporated non-energy benefits.

Technical potential refers to the maximum savings that could be achieved if every cost effective efficiency measure were implemented in every customer facility – residential, commercial and industrial. Achievable potential is the portion of technical potential that will likely be viable over the planning horizon, given market barriers that could limit implementing demand-side measures.

To determine the achievable conservation potential available to meet resource needs, the CPA first attempts to identify all technical or demand-side resource opportunities from conservation that could be captured regardless of costs or market barriers.

In order to comply with Initiative 937 requirements, the percentage for achievable potential assumptions was revised to 85 percent for all discretionary measures (existing buildings and equipment) and 65 percent for all lost opportunity measures (new buildings and equipment) for the 2012 IRP. The result was an achievable cost effective conservation potential that totals 206.6 aMW over the 20-year planning horizon.

Modeling Conservation in the 2012 IRP

In I-937, the target for renewable resources is a percentage amount based on the average load of the previous two years. To the extent that conservation reduces load, it also reduces the need to purchase expensive new renewable resources. Thus, results of this information gathering and reassessment demonstrated that even with the additional costs of accelerating conservation, total costs remained well below the cost of new generating resource alternatives.

In the 2012 analysis, staff modeled alternative levels of conservation in the various portfolios and then compared them in order to identify the most cost-effective portfolio design. In the years between each IRP, an avoided cost is used as a cost-effectiveness test. The levelized cost of the

marginal resources in the preferred portfolio is used to evaluate the cost-effectiveness of conservation efforts. In general, the reported conservation cost structure suggests that the cost of conservation as compared to the IRP avoided cost (based upon the preferred portfolio) has not been a meaningful constraint. The most meaningful constraints to conservation have been physical. In the 2010 IRP, City Light found that it should acquire conservation as quickly as possible, as long as its cost structure was significantly below the levelized avoided cost threshold.

In estimating the pace of accelerating conservation, the model logic does not address practical considerations of conservation program implementation. For accelerated conservation, the relevant question was implementation: “How quickly can City Light actually ‘mine’ discretionary conservation from existing buildings?” The answer to this depends on issues such as City Light’s and customers’ budgets, policy-makers’ priorities, customer incentives, staffing, office space, consultants, conservation contractors, and coordination of schedules.

Nevertheless, for the 2012 IRP, four different levels of conservation were used for the candidate portfolio modeling. Figure 1 reflects the four conservation paths used in Round 1 portfolios.

Figure 1: Cumulative Conservation by Year in Round 1 Modeling

	Constant Rate	Lower	Base	Higher
2012	14	13	14	14
2013	27	25	27	29
2014	39	36	41	45
2015	50	48	55	61
2016	62	59	69	77
2017	73	71	83	93
2018	85	82	97	109
2019	97	94	111	125
2020	108	105	125	141
2021	120	117	139	157
2022	132	128	153	173
2023	143	140	167	182
2024	155	151	181	191
2025	167	163	194	199
2026	178	171	204	207
2027	190	179	212	214
2028	202	186	219	221
2029	214	193	226	227
2030	225	200	233	233
2031	237	206	237	237

GENERATION RESOURCES

Generation resources produce electrical energy from other forms of energy, such as heat or solar; or potential energy, from wind or falling water. The types of generation resources analyzed for an IRP are proven and commercially available. Generation resources added to City Light’s existing portfolio will have characteristics important to City Light’s future needs, the most important characteristics being costs, dispatchability, transmission requirements and environmental attributes.

Evaluating the Resources

This section provides descriptions of the types of generating resources that were included in candidate resource portfolios and evaluated for the 2012 IRP.

- Hydroelectric Efficiency (Gorge Tunnel 2)
- Wind Power
- Waste Wood Biomass
- Geothermal
- Landfill Gas
- Solar Photovoltaic (PV)
- Solar Thermal
- Natural Gas-Fired Combined-Cycle Combustion Turbine (CCCT)

As research and development continue for new or enhanced types of generating resources, it is difficult to predict future technological advancements and how they will affect resource costs and availability. Thus, most IRPs identify and monitor promising generating resource technologies that may become technically viable and commercially available, but do not include them in the quantitative analysis. Washington state law governing IRPs states that IRPs should contain commercially available technologies and select resources with the lowest reasonable cost. In keeping with state law and IRP best practices, the IRP does not contain forecasts of new technologies or their costs.

Selecting a Range of Resources

The IRP staff followed a structured process to compare and choose from an array of available resource types, and evaluated more types of generating resources than were included in the recommended resource portfolio. Including a broad range of resource types has advantages, including the assurance that the IRP process is objective and does not prematurely narrow the field of resource alternatives. Each

type of generating resource has a unique combination of advantages and disadvantages, including costs, benefits, opportunities and risks. Evaluating a particular resource does not imply a predetermined preference for or against including it in City Light's portfolio.

Analyzing various types of generating resources helps to identify which combinations of new resources can best complement the existing resources in City Light's portfolio. A single type of generating resource is unlikely to meet all of the utility's long-term needs, while a diversified mix of resources is more likely to meet the utility's objectives of maximizing reliability and minimizing cost, risk and environmental impacts.

The net impacts of a particular type of generating resource on the utility's overall resource portfolio are often not obvious and can remain obscured if the resource is only evaluated on a stand-alone basis.

Various types of generating resources have proponents and opponents. Quantitative analysis of candidate resource portfolios that combine a variety of resource types provides the means to incorporate input from many perspectives. Quantitative analysis of candidate resource portfolios with different mixes of resources can produce useful information for selecting a long-term resource strategy.

Based on results from quantitative analysis, City Light's candidate resource portfolios contain resources that are known to be commercially viable at the point the IRP is produced. Some resources were not included in the quantitative analysis because their costs are significantly higher than alternative renewable resources, or they are not commercially available to City Light. In 2009, City Light began conducting an annual Request for Proposals (RFPs) in order to provide more complete information on resource costs and availability. City Light uses this information to inform resource costs in the 2012 IRP and for acquisition of resources or renewable energy credits for compliance with I-937. However, even RFPs are not always reflective of the true cost of a resource due to local market constraints and the bidding strategies of market participants in the RFPs.

Costs of New Generation Resources

The recession has driven mixed results for resource costs. The value of the U.S. dollar affects costs for new resources that involve imported machinery and materials. For example, the cost of new wind turbines, many imported from Europe, have not fallen significantly despite declining demand as a result of transportation costs and a weaker U.S. dollar. Conversely, declining natural gas demand and a new fracking technology for shale gas formations have led to drastically lower natural gas costs, driving down generation costs for natural gas-fired combined cycle and simple cycle turbines. In future years, City Light expects to see higher capital costs for resources than represented in the 2012 IRP, as economic growth slowly improves.

Information about the costs of new resources came from many sources, including the City Light request for proposals (RFP), the U.S. Department of Energy, Northwest Power and Conservation Council, California Energy Commission, and Northwest Utility Integrated Resource Plans. Not all cost information from these sources was consistent, despite adjustments for heat rates, capacity factors and other factors. In these cases, a cost was selected that fell within the middle of the range.

Transmission costs for new resources are assumed to be consistent with the BPA's policy for new transmission. This policy is that the BPA will build new transmission as needed by its customers, not to exceed an amount that would increase rates by 5 percent.

Figure 2 provides costs and other assumptions for new generation resource options that were evaluated in the 2012 IRP.

Figure 2: New Generation Resource Options Evaluated in 2012 IRP

Resource	2010 \$/ MWh
CCCT	\$ 63
Landfill gas	\$ 67
Waste Wood Biomass	\$ 86
Hydro Efficiency	\$ 88
PNW Wind	\$ 93
Geothermal	\$ 99
Solar Photovoltaic	\$ 210
Solar Thermal	\$ 312

Resources Evaluated in the IRP

As mentioned earlier, the most important characteristics of a generation resource added to City Light's current portfolio are costs, dispatchability, transmission requirements and environmental attributes. For each new generation resource evaluated, the following basic information was gathered:

- Resource technology and fuel
- Current status and outlook
- Resource characteristics (dispatchability, transmission requirements, and environmental attributes)

HYDROELECTRIC EFFICIENCY IMPROVEMENT

City Light has pursued ongoing efficiency improvements to the hydro plants that it owns, including replacement of turbines and runners, on a prescribed schedule. The new hydroelectric resource considered for this IRP is an efficiency improvement at Gorge Dam, part of City Light's Skagit Project.

HYDROELECTRICITY EFFICIENCY IMPROVEMENTS	
Technology & Fuel	The Gorge Reservoir supplies water to the powerhouse through a single tunnel. The efficiency improvement would involve the installation of a second tunnel that would decrease flow velocities, reduce energy lost to turbulence when water flows at high velocity, and reduce the frictional losses that occur between the water and the tunnel wall, thereby increasing the effective hydraulic head. Greater power production would result for the same amount of water. This efficiency improvement would increase annual generation by about 5.40 average megawatts. In January, generation is estimated to increase by 5.14 average megawatts.
Current Status & Outlook	A FERC license amendment and other permits are required for this project. City Light has put this project on hold, but has continued with completing the design phase.
Characteristics	<p>Transmission requirements. Already available.</p> <p>Dispatchability. The output from the hydroefficiency would be dispatchable.</p> <p>Environmental attributes. The generation from the hydroefficiency improvement would be a renewable resource. City Light released an environmental assessment of the project in August 2010. The link to this document is: http://seattle.gov/light/g2t/docs/Exhibit%20E%20-%20APEA.pdf</p>

WIND POWER

The use of wind power has increased rapidly, making it the predominant renewable resource technology in the Pacific Northwest, where the installed capacity of wind power projects has increased from zero to more than 3,000 megawatts in the last decade.

WIND POWER	
Technology & Fuel	Wind power is the process of mechanically harnessing energy from the wind and converting it into electricity. The amount of wind power that can be produced at a given place is dependent on the strength and frequency of wind. Wind velocity and frequency is particularly important, because the quantity of power increases as wind speed and frequency of wind increases. Wind turbine generators are grouped together in order to maximize energy output and minimize costs. Wind power has no fuel cost. However, lease payments to landowners are a cost of accessing the wind “fuel”.
Current Status & Outlook	The Northwest Power and Conservation Council (NPCC) estimates the potential for wind power in the Pacific Northwest as exceeding 6,000 megawatts. State requirements for renewable resources, including Initiative 937 in Washington, are driving the development of new wind power.
Characteristics	<p>Transmission requirements. The cost of transmission for wind power is higher per megawatt-hour than for other generating resources because it has a low capacity factor.</p> <p>Dispatchability. Wind power is not a dispatchable resource. One approach for firming up the intermittent generation from wind power projects is to coordinate their operation with dispatchable resources (e.g., combustion turbine generation) or with resources that have the ability to shape or store energy (e.g., hydroelectric generation).</p> <p>Environmental attributes. Wind power is renewable and does not consume fossil fuels or produce air emissions. Primary environmental concerns are bird and bat mortality and visual impacts.</p>

BIOMASS

Biomass generation is the production of electricity using biomass fuel, made from organic material that can be burned or converted into a combustible material. Examples of biomass fuels that can be used to generate electricity include waste wood (e.g., residues from forest thinning, logging and mill processes), methane produced at wastewater treatment plants, and methane produced from the decomposition of animal manure, agricultural residues and energy crops.

For the 2012 IRP, waste wood biomass plants were modeled. Extremely large amounts of biomass fuels are usually not available near any single location, thus incurring transportation expense. Most future wood biomass plants are expected to have generating capacities of between 10 megawatts and 25 megawatts.

BIOMASS	
Technology & Fuel	<p>The raw forms of many biomass fuel sources have low energy content, so generating electricity from biomass requires large quantities of organic material. Biomass is converted into fuel using thermochemical or biochemical technologies.</p> <p>Both types of technology generate electricity by processing biomass into a combustible fuel and burning it. Conventional steam-electric turbines with or without cogeneration are the chief technology for electricity generation using wood-derived fuels.</p>
Current Status & Outlook	<p>Limited opportunities to acquire these types of generating resources are expected, and costs and other characteristics are situation-specific.</p> <p>While woody residue is available in large quantities, the high cost of collection and transportation limits the economics of plants distant from fuel sources. Technical difficulties and seasonality of fuel availability preclude significant use of agricultural field residues for generation. A small, undeveloped potential for energy recovery exists at municipal wastewater treatment plants. City Light has contracted to purchase power from King County's West Point Water Treatment Facility. Start-up tests began in the summer of 2012.</p>
Characteristics	<p>Transmission requirements. Biomass generation is usually sited near transmission or distribution lines.</p> <p>Dispatchability. Biomass generating resources usually operate as baseload generation.</p> <p>Environmental attributes. Most biomass fuel is a renewable resource, with low environmental impacts. Biomass generation does not add large net amounts of carbon dioxide to the atmosphere, but it does emit nitrogen oxides and particulate matter. Biomass generation based on conventional steam-electric turbine technology consumes significant amounts of water – up to 55,000 gallons per megawatt-hour, depending on fuel source and production technology.</p>

LANDFILL GAS

Landfill gas is a product of the natural degrading and decomposition of municipal solid waste by anaerobic microorganisms in sanitary landfills. The gases produced, carbon dioxide and methane, can be collected by a series of low-level pressure wells and can be processed into a gas that can be burned to generate steam or electricity.

City Light began taking power (six aMW) from Columbia Ridge landfill gas plant in 2010.

LANDFILL GAS	
Technology & Fuel	<p>As organic materials in solid waste landfills decompose anaerobically, high concentrations of combustible gases are released. Landfill gas is composed of 50 to 60 percent methane; most of the rest is carbon dioxide. These gases can be put to productive use as fuel for generating electricity using internal combustion engines or combustion turbines. Generation capacity is usually 10 megawatts or less.</p> <p>Fixed and variable costs for landfill gas projects depend on the type of generating technology that is used. Smaller projects use internal combustion engines, while larger projects use combustion turbines.</p>
Current Status & Outlook	<p>Landfill gas is used to produce electricity at over 380 landfills in the United States.</p> <p>Landfill gas generating projects use mature technologies. Future availability of opportunities to develop landfill gas generating projects will be influenced by the number and location of solid waste landfills.</p>
Characteristics	<p>Transmission requirements. Most solid waste landfills are already served by the local electrical transmission and distribution network.</p> <p>Dispatchability. Most landfill gas generating projects are operated as baseload resources in order to ensure that all gas is burned.</p> <p>Environmental attributes. Net environmental impacts are small. Landfill gas projects consume a fuel source that would otherwise be flared. Landfill gas may contain impurities that can create hazardous air emissions unless they are removed, usually by filtration of the gas prior to combustion. Depending on where the landfill is located and neighboring land uses, noise may need to be controlled.</p>

GEOHERMAL

Geothermal is the only large renewable resource that combines base load generation with long-term firm fuel supply and scalability. While other renewable energy resources like wind and solar energy generate power intermittently, and hydro availability varies from year to year, geothermal operates over 95 percent of the time and may operate for 100 years or more.

Geothermal plants are typically built as 20 to 50 megawatt units, but modular systems are as small as five megawatts. The most likely locations in the Northwest are the Basin and Range geologic province that extends over southeastern Oregon and southern Idaho and the High Cascades. Binary technology was modeled for the 2012 IRP.

GEOHERMAL	
Technology & Fuel	Geothermal energy is derived from heat that originates deep in the earth's crust. There are three basic types of geothermal generating technologies: dry steam, flash, and binary.
Current Status & Outlook	A Western Governors' Association Geothermal Task Force Report estimates nearly 1,300 megawatts of developable geothermal generation in Washington. However, the outlook for development of geothermal generating resources in Washington and parts of the Pacific Northwest is unclear because extensive exploratory drilling has not been done. The most likely locations are in the Basin and Range geologic province in Oregon and Idaho.
Characteristics	<p>Transmission requirements. Sites with geothermal potential are located near City Light owned or controlled transmission. Upgrades to the existing transmission system may be necessary. Geothermal is easy to integrate into a hydroelectric system because it has a high capacity factor.</p> <p>Dispatchability. Geothermal energy is usually operated as a baseload resource but it has some limited dispatchability on-peak and off-peak.</p> <p>Environmental attributes. Geothermal energy is a renewable resource. No fossil fuels are consumed, but the potential for release of gases (though low for binary), potential impacts to ground and surface water, and land use issues make it difficult to site in wilderness areas.</p>

NATURAL GAS: COMBINED-CYCLE COMBUSTION TURBINES & SIMPLE-CYCLE COMBUSTION TURBINES

Combustion turbine technology has been used to generate electricity for several decades. Natural gas generation considered for the 2012 IRP is combined-cycle combustion turbines (CCCTs).

NATURAL GAS	
<p>Technology & Fuel</p>	<p>A combustion turbine is a rotary engine composed of three basic parts. Air is taken in through a compressor and then natural gas is mixed with the air and burned in a combustion chamber. The resulting mechanical energy is then used to turn a turbine at a speed of 3,600 revolutions per minute.</p> <p>There are two types of combustion turbines. The combined-cycle combustion turbine (CCCT) uses the combustion turbine to generate power and then recovers exhaust heat from the combustion turbine to make steam for a turbine generator that in turn produces additional power. The simpler and less fuel-efficient simple cycle combustion turbine (SCCT) generates power directly, without recovery of exhaust heat as in combined cycle turbines.</p> <p>CCCTs are more complex than SCCTs, and have higher capital costs. However, CCCTs are more fuel-efficient, with total running costs lower than for SCCTs. Both CCCT and SCCT projects are primarily fueled with natural gas.</p>
<p>Current Status & Outlook</p>	<p>In the Pacific Northwest, there is over 4,000 megawatts of CCCT generating capacity. The Northwest also has slightly more than 1,500 megawatts of SCCT generating capacity.</p> <p>Historically volatile natural gas prices and surplus generating capacity in the Pacific Northwest had slowed the development of new combustion turbine generating projects until recently. However, new shale gas supplies and much lower natural gas prices are spurring an upswing in natural gas-fired generation development. This trend is expected to strengthen further as the economic recovery continues.</p>
<p>Characteristics</p>	<p>Transmission requirements. Siting requires access to a natural gas pipeline and electric transmission.</p> <p>Dispatchability. Combustion turbines are highly dispatchable. SCCT generating units can go from a cold start to full operation in less than 10 minutes. CCCT generating projects can be started up and shut down in a matter of hours. Combustion turbines operate at highest efficiency under full load. Because SCCT generating projects have higher operating (fuel) costs than CCCT generating projects, SCCTs are usually used to meet peak load requirements and provide standby for system reliability purposes. CCCT generating projects are normally used more for base load and mid-range purposes.</p> <p>Environmental attributes. Combustion turbines emit carbon dioxide (CO₂), small amounts of sulfur dioxide (SO₂), nitrogen oxides (NO_x), and other air pollutants. Control technologies are used to eliminate most emissions of SO₂ and NO_x. CO₂ production remains a major consideration. Also, some projects require large amounts of water, and there are impacts from fuel extraction and transportation.</p>

MARKET RESOURCES

A transmission grid system that serves the 11 states of the Western Region enables City Light to participate in many types of wholesale power market transactions. Seasonal exchanges and short-term energy and capacity purchases can be used to “reshape” power from spring to winter, flattening the resource shape and making more energy available to meet winter peak demand.

Seasonal Exchanges

A seasonal exchange is a power transaction that takes advantage of the seasonal diversity between Northwest (winter peaking) and Southwest (summer peaking) loads. City Light can transfer firm power from north to south during the Southwest’s summer load season and from south to north during the Northwest’s winter load season. Exchanges are helpful in meeting the utility’s seasonal resource needs since it enables the utilities in both regions to maintain less generating capacity than would otherwise be necessary. City Light’s current portfolio includes a seasonal exchange with utilities in Northern California.

Exchanges are often done on a megawatt-hour for megawatt-hour basis, though the actual delivery schedules of firm energy in the exchange may vary. For example, one utility could deliver 25 aMW for four months of the year while the other utility delivers 50 aMW for two months of the year. In modeling exchanges, energy transfers were not megawatt-hour for megawatt-hour on a calendar year basis, since winter transfers to Seattle occur from November through February, bridging calendar years, while transfers during the summer months occur within the same calendar year.

When assessing seasonal exchanges or short-term energy “reshaping” transactions, staff analysts first determined whether or not City Light has sufficient rights to firm transmission capacity available along the transmission path between the winter peaking utility (such as City Light) and the summer peaking utility (in, for example, California or the Desert Southwest).

Another important consideration in assessing exchanges is ensuring that the total amount of energy City Light delivers during the summer months does not deprive City Light of energy it needs to meet its growing summer loads.

Capacity Purchases

A capacity purchase contract gives the buyer the right to a given amount of electric power at an established price. The contract usually identifies the generating resource(s). If and when the terms are exercised, the buyer takes delivery of power up to the maximum amount the contract specifies. Capacity purchase contracts were evaluated in previous IRPs, but were not explicitly considered in the 2012 IRP.

Seasonal capacity contracts are flexible as a resource and can ensure the availability of power when needed on a seasonal or temporary basis, without City Light bearing the full cost or risk of long-term resource ownership. The utility pays a fee to the owner of the generating resource for providing this service. If the utility exercises the contract terms, it pays the pre-negotiated price for the amount of power produced by the generator party to the contract.

A number of factors can affect the availability and costs of capacity purchases, such as the balance of supply and demand in the power market; price volatility in the market; prevailing prices when the contract is negotiated; and expectations of both the utility and the seller about the future of the power market. The greater the length of time before a capacity purchase is made, the less information is available about these factors and the price is higher.

In previous IRPs, City Light considered purchasing them in different years throughout the 20-year planning horizon, mostly as a tool for balancing resource requirements. For planning purposes, the cost of the premium for a capacity purchase was estimated as the fixed costs of a simple-cycle combustion turbine for the period covered by the contract, plus a return on investment for the turbine owner.

City Light does not view seasonal capacity contracts as a substitute for a generating resource, because there is much more uncertainty about their long-term availability and cost. When planning for the long-term, capacity purchases are typically only used to bridge a gap in resources for a few years at a time in the candidate portfolios, until load grows large enough to merit purchasing or building another firm generating resource.

RESOURCE ADDITIONS AND PORTFOLIO DESIGN CONSIDERATIONS

In planning the 2012 IRP and considering new resources, City Light begins by examining the particular characteristics of each resource, e.g., cost, reliability, and so forth. We have also taken into account the requirements of I-937, referenced throughout this report; renewable energy credits (as they relate to I-937); and the future need for new transmission for new resources. These considerations are described below.

Initiative-937 Resource Requirements

I-937, the Energy Independence Act, was passed by Washington voters in November 2006. City Light meets the renewable resource requirement through 2020 because of wind energy purchased from Stateline Wind Project and forward purchases of renewable energy credits (RECs). Until then, resource adequacy is the main consideration in renewable resource acquisition choices.

Renewable Energy Credits

Renewable Energy Credits (RECs) are tradable certificates that represent the environmental attributes of one megawatt-hour of electricity generated by a power plant that is a qualifying “renewable” resource under state law. The credits are also known as Green Tags, Renewable Energy Certificates (RECs), or Tradable Renewable Certificates (TRCs). Qualifying resources include power generated with solar, wind, geothermal, tidal, wave, and biomass resources. Some states define hydropower as renewable. Washington state’s definition of renewable resources includes only new hydropower generated as a result of certain efficiency-related investments at existing hydropower plants.

RECs can be purchased or traded so that the holder of the certificate can claim purchase or use of new renewable energy, despite having used power generated with large hydro or non-renewable resources. Electric utilities can use RECs to comply with state laws that require them to use a certain percentage of new renewable energy in serving retail customers.

In Washington state, the Western Renewable Energy Generation Information System (WREGIS) serves as the regulatory tracking system for RECs. Registration and tracking of RECs by WREGIS helps to ensure that RECs are properly assigned to their owners, are not double-counted and are retired after they have been consumed.

In addition to tracking, other organizations certify RECs as meeting important environmental and consumer standards. City Light certifies the RECs used in its voluntary “Green-Up” program for retail customers with the Green-e Renewable Energy Program. The Green-e certification ensures that “Green Up” meets strict environmental and consumer

protection standards established by the non-profit Center for Resource Solutions.

Washington state utilities can purchase RECs from qualifying renewable energy resources in Oregon, Idaho, and western Montana in addition to in-state. Washington state law will impose a \$50/MWh fine (in 2006 dollars) for failure to have sufficient qualifying renewable energy or RECs to meet the state requirements under Initiative 937. REC prices in Washington today have been influenced by energy legislation and policies in California, which constrain the ability of California utilities to acquire RECs from the Pacific Northwest. This has created a surplus of RECs in the Pacific Northwest and driven REC prices down.

Of particular importance for City Light, a utility can be awarded non-tradable RECs for investing in many kinds of hydro efficiency projects. For each incremental MWh generated as a result of these efficiency measures, City Light receives one non-tradable REC. These non-tradable RECs can be used to meet I-937 requirements for renewable energy, the same as tradable RECs. City Light has and continues to make investments in efficiency measures at its hydroelectric plants. These measures may include structural changes, upgrades to turbines and runners, more efficient transformers, and other equipment. An example is City Light’s planned efficiency improvement at the Gorge power plant, Gorge Tunnel 2, described earlier in this appendix.

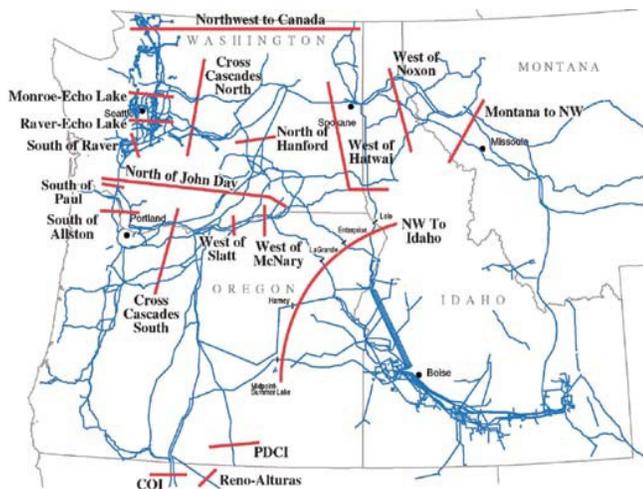
Transmission for New Resources

City Light owns only 657 miles of transmission facilities – primarily from the Skagit Hydroelectric Project to its service area – and a share of the Third AC Intertie. The utility is dependent upon access to transmission systems owned by others to reach the Western power market for balancing its seasonal power supply surpluses and deficits, as well as gaining access to new power supplies in the future. The capacity of the existing regional transmission system – of which approximately 70 percent is owned and operated by BPA – is almost fully subscribed, and available capacity on key transmission paths is extremely limited. The congested transmission paths, or flowgates, in the Northwest are shown in Figure 3.

As congestion in the Western grid continues to increase, existing firm transmission rights become more valuable and acquisition of new transmission capacity, from existing transmission providers, becomes more difficult. And as the transmission system ages, more frequent and longer duration maintenance outages are needed to maintain system capacities and prevent path deratings. Scheduled outages often cause inefficient management of generation resources.

Key to City Light’s long-term resource planning is whether or not new transmission facilities can be permitted and built, so that energy from distant, new generating resources can be delivered to Seattle.

Figure 3: Northwest Constrained Transmission Paths



TRANSMISSION CONTRACTS

City Light has long-term firm transmission contracts that provide point-to-point (PTP) contract demand rights of approximately 2,000 MW. These rights are predominantly purchased from BPA under its Federal Energy Regulatory Commission- (FERC) compliant open-access transmission tariff and provide distinct quantities of transmission capacity on a point-of-receipt to a point-of-delivery basis.

These rights provide City Light with some flexibility to secure firm transmission for resources located to the east and south of Seattle. City Light also has transmission agreements for lesser quantities of transmission service with PacifiCorp, Idaho Power, Avista and Puget Sound Energy.

City Light has reserved most of this transmission capacity for current operations by designating the plant capacity at the point-of-receipt, thus leaving limited transmission transfer capability available for use in acquiring future distant resources, most likely after 2020. Newly proposed changes in transmission service are creating some future uncertainty in City Light's transmission rights at the time of publication of the 2012 IRP. Any changes in transmission rights will be considered within the 2014 IRP update.

DESIGNING CANDIDATE PORTFOLIOS

After gathering information on the range of resources that might be added to City Light's existing resource portfolio, candidate portfolios were constructed in order to meet these objectives:

- Minimize the amount of resources needed to meet resource adequacy and I-937 requirements, largely by accelerating the acquisition of conservation.
- Use lower cost resources, such as seasonal exchanges, short-term market energy and capacity purchases in the early years to minimize the net present value of the cost of the portfolios and avoid large resource commitments.
- Produce portfolios that will meet the resource adequacy requirement and I-937 requirements.
- Use scalable resources when possible as opposed to separate projects (e.g., wind, geothermal, combustion turbines). Ensure that there is sufficient new generation in summer months to meet proposed seasonal exchanges.
- Avoid exchanges or resources in the early years that would require new transmission to be constructed on an unreasonably short timeline.