2008 Integrated Resource Plan – Executive Summary

The Recommended Resource Strategy

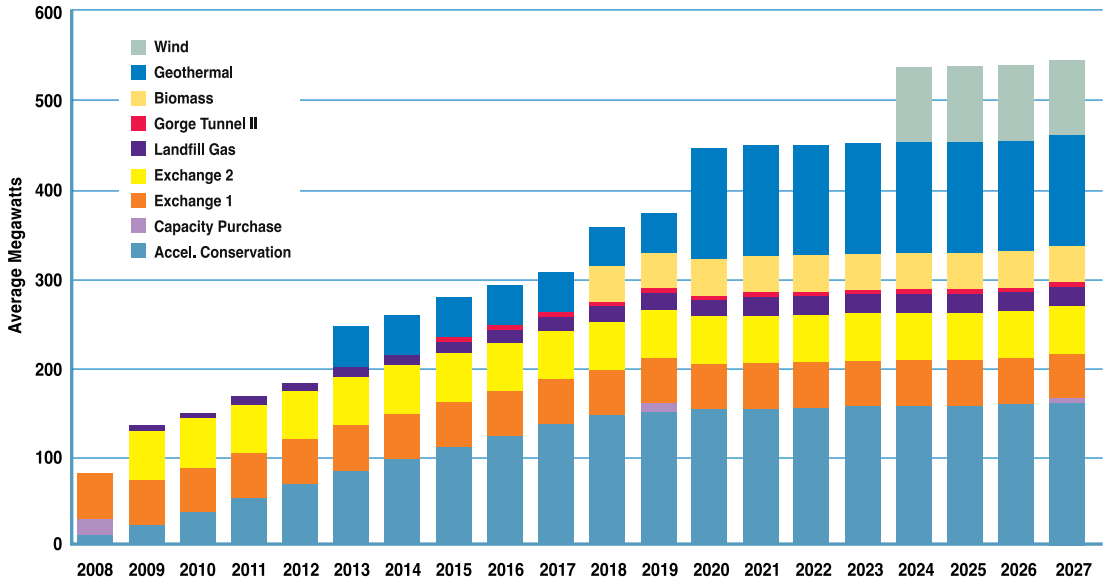
Seattle City Light's 2008 Integrated Resource Plan (IRP) identifies how much additional power the utility needs in the winter (when highest demand occurs) through 2027. It demonstrates how the utility plans to meet growing resource demand within a policy context. It evaluates candidate resource portfolios against four criteria - reliability, cost, environmental impact and risk - balancing these criteria with public input from a wide range of perspectives.

To meet winter resource needs, City Light's 2008 IRP recommends a long-term conservation and power resource strategy and a short-term action plan. The recommended long-range resource acquisition strategy recommends these steps:

- Accelerating the acquisition of cost-effective conservation.
- Instituting cost-effective seasonal power exchanges designed to increase available winter energy, beginning in 2009.
- Exercising City Light's preference rights for the purchase of low-cost power from the Bonneville Power Administration (BPA) in a new contract beginning in 2011.
- Planning for the near- to mid-term purchase of output from low-cost renewable resources such as a small, new landfill gas project.
- Acquiring output from other renewable resources such as geothermal, biomass, and wind beginning in 2012, to meet resource adequacy requirements and in compliance with Washington state Initiative 937.

The recommended resource strategy is a continuation of the utility's policy of obtaining low-cost power with low environmental impacts for its ratepayers/owners (see graph below) while making the most of its existing resources. Conservation is the first choice resource, followed by seasonal exchanges that help shape resources to load. City Light expects its access to low-cost federal power via BPA will be locked in for 20 years, beginning in 2011. Market-based purchases take place when a resource need exists without enough justification to acquire new resources. When new resources are needed, the lowest-cost renewable resources are acquired first, followed by higher-cost renewable resources.

Recommended Portfolio to Meet Winter Resource Needs and Initiative 937



Integrated Resource Planning Process

The two-year planning process that culminated in City Light's preferred portfolio included these steps:

- Public Involvement of citizens and stakeholders with diverse perspectives.
- Recruiting expertise from inside and from outside the utility.
- Licensing and installing a sophisticated computer model, the AURORAxmp® Electric Market Model, for power planning.
- Calibrating the model for the characteristics of City Light's complex hydroelectric operations and purchase power contracts.
- Thoroughly assessing conservation resource potential in the service area.
- Forecasting customer demand for power each month through 2027.
- Developing a resource adequacy measure, crucial for defining the timing and amount of future need.
- Developing costs and characteristics of alternative resources to be included in the candidate resource portfolios.
- Constructing and modeling Round 1 candidate resource portfolios for evaluation against four criteria: Reliability, cost, risk and environmental impacts.
- Constructing and modeling Round 2 candidate resource portfolios, based on findings and comments in response to Round 1.
- Updating an Environmental Impact Statement (EIS) for new resource portfolios.
- Recommending a resource strategy and near-term resource action plan.

Public Involvement

The IRP stakeholder committee represents residential, commercial and industrial customers, environmental organizations, power resource developers and energy-related government agencies. This committee guided resource planning efforts during five meetings with comments, questions and suggestions throughout the process. Members of the public also attended IRP public meetings and offered suggestions that helped to shape the analyses used in the planning process.

The IRP was developed in two phases. Phase 1 identified proposed assumptions, including projected peak demand, forecasts of future energy prices, availability of spot market purchases, resources to consider, resource costs, performance measures and a wide range of potential resource portfolios that could meet the projected demand.

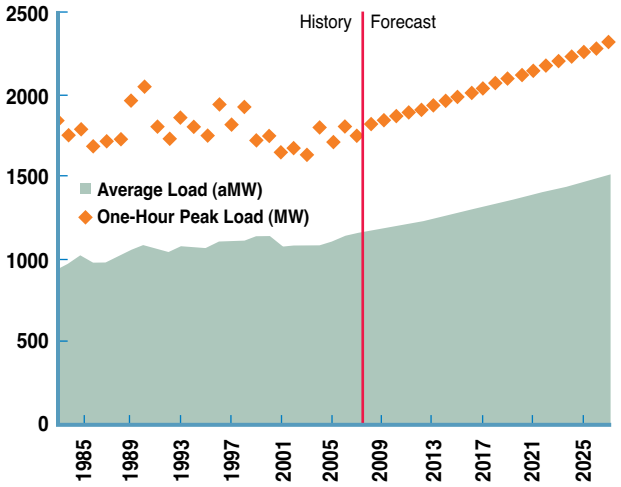
These assumptions were adjusted in response to public input. The operations of the alternative resource portfolios were then simulated using a sophisticated computer model. The results of the computer modeling of power operations were evaluated for performance, using the four criteria of reliability, cost, risk and environmental impact.

In phase 2 of the IRP process, lessons learned from the first phase were used to construct a different set of resource portfolios, in order to improve their performance based on the four criteria. After this analysis, a recommended resource portfolio was identified.

Load Forecast and Resource Adequacy

A first step in assessing the need for additional resources is a forecast of future need, taking into account the load forecast and the desired level of resource adequacy. The utility's long-range forecast projects continued load growth for the service area. The IRP treats conservation as a resource and evaluates it in the same way as it evaluates other resources. The graph below shows the load forecast assuming no new programmatic conservation.

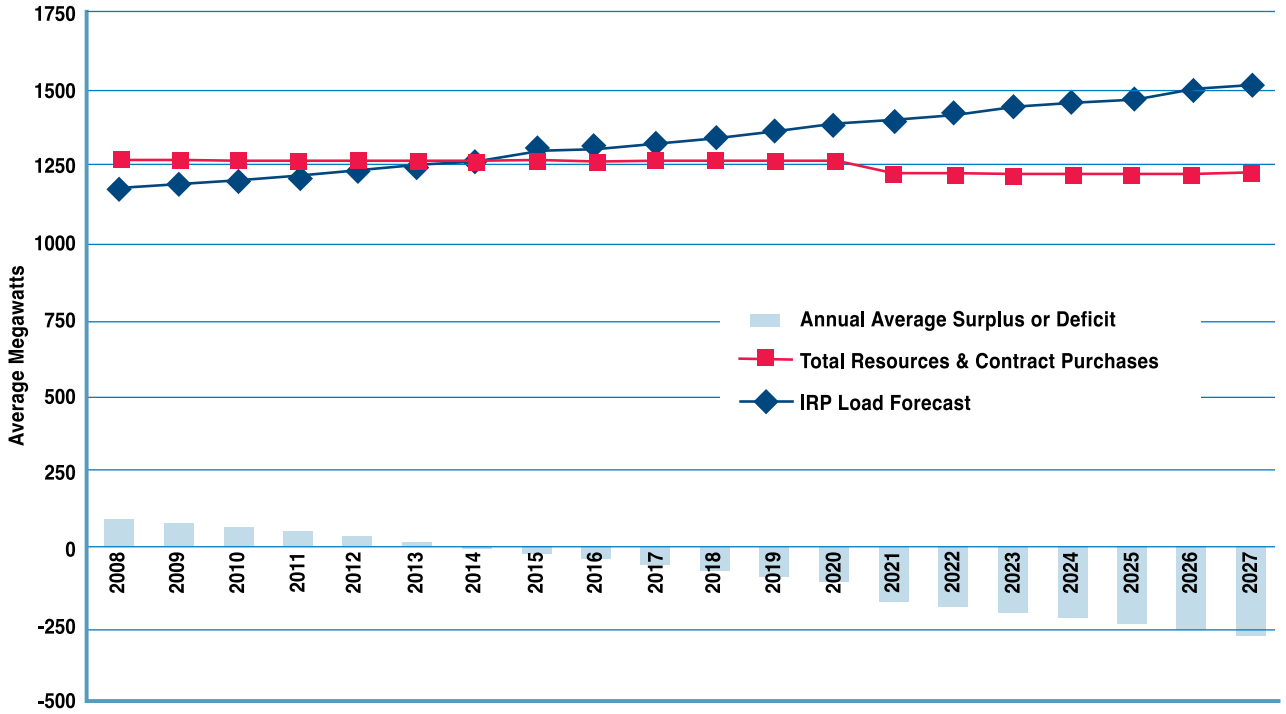
System Annual Load History and Forecast (with no new conservation resources)



City Light provides a high level of resource reliability, including the ability to serve load even when hydro generation capability is low. In an average water year and with normal temperatures, City Light has substantial surplus power available to sell in the wholesale power market, even during the winter. Under critical water, however, City Light would be short of firm resources on an annual basis in 2014, as seen in the following graph.

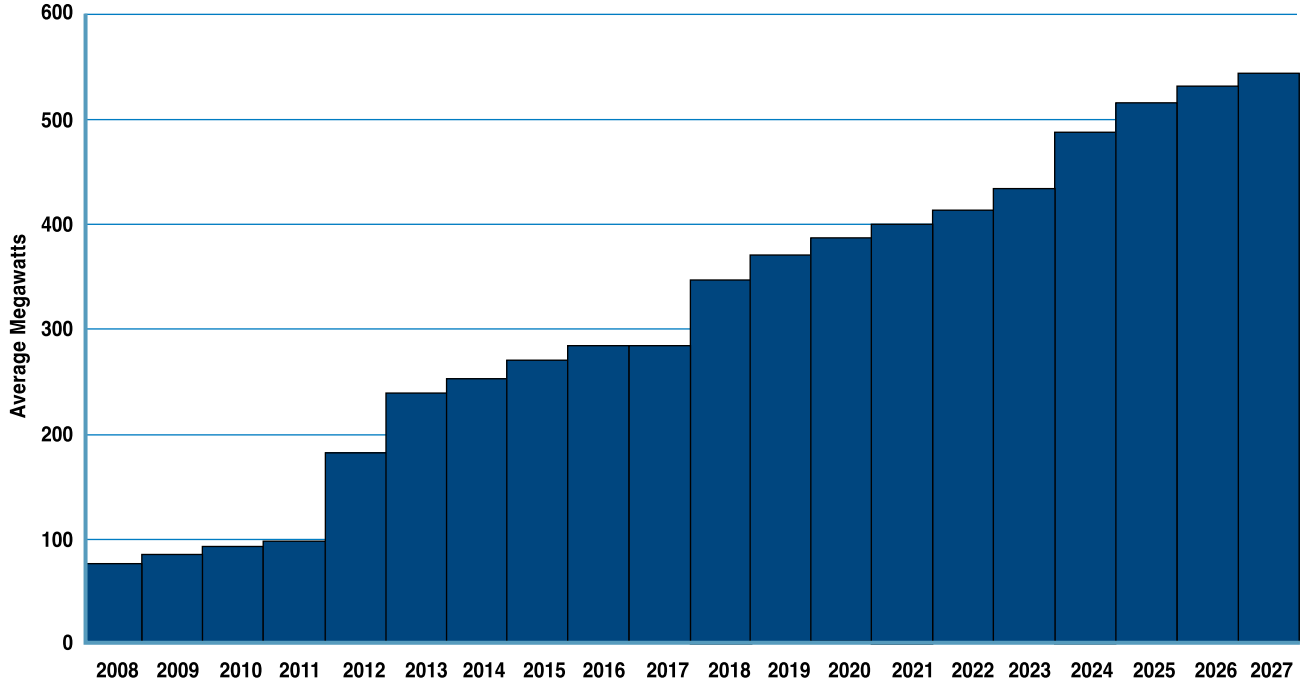
In addition to an annual average basis, City Light must also have sufficient resources on a monthly, weekly and hourly basis. Since City Light is a winter peaking utility, the winter months are of most concern. City Light's annual peak demand most often occurs in January. The 2008 IRP relies on a measure of resource adequacy that ensures that the utility has a 95% confidence level of meeting loads in any given January. Low generation capability is usually due to drought conditions in the Pacific Northwest. High customer demand is usually due to extremely low temperatures in the winter. The greatest threat to City Light's resource reliability is the combination of low water and high customer demand for power.

IRP Load Forecast and Existing Firm Resources

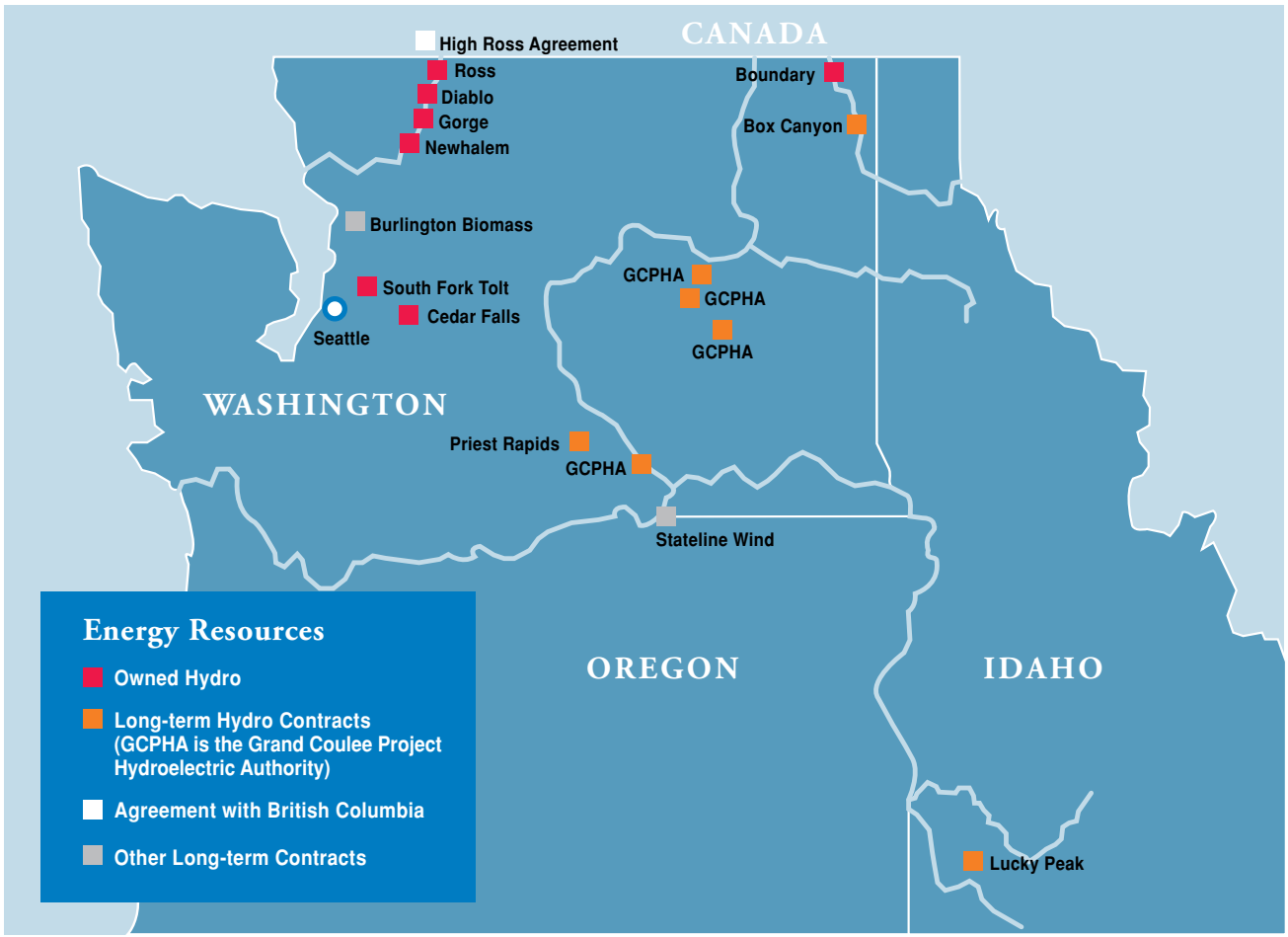


Using the 95% resource adequacy measure and assuming that 100 average megawatts of power can be purchased from the spot market even under the most extreme conditions, modeling the operation of City Light's existing resource portfolio shows that the utility needs additional winter resources in January 2009. This winter need in 2009 increases through time as load grows and as existing contracts expire. By 2027 the need for power in the winter grows to 544 average megawatts in the winter and 200 average megawatts in the summer. The timing and amount of winter resources needed for a combination of resource adequacy and Initiative 937 requirements is shown below.

New Resources for Winter Resource Adequacy



Seattle City Light's Generation Resources



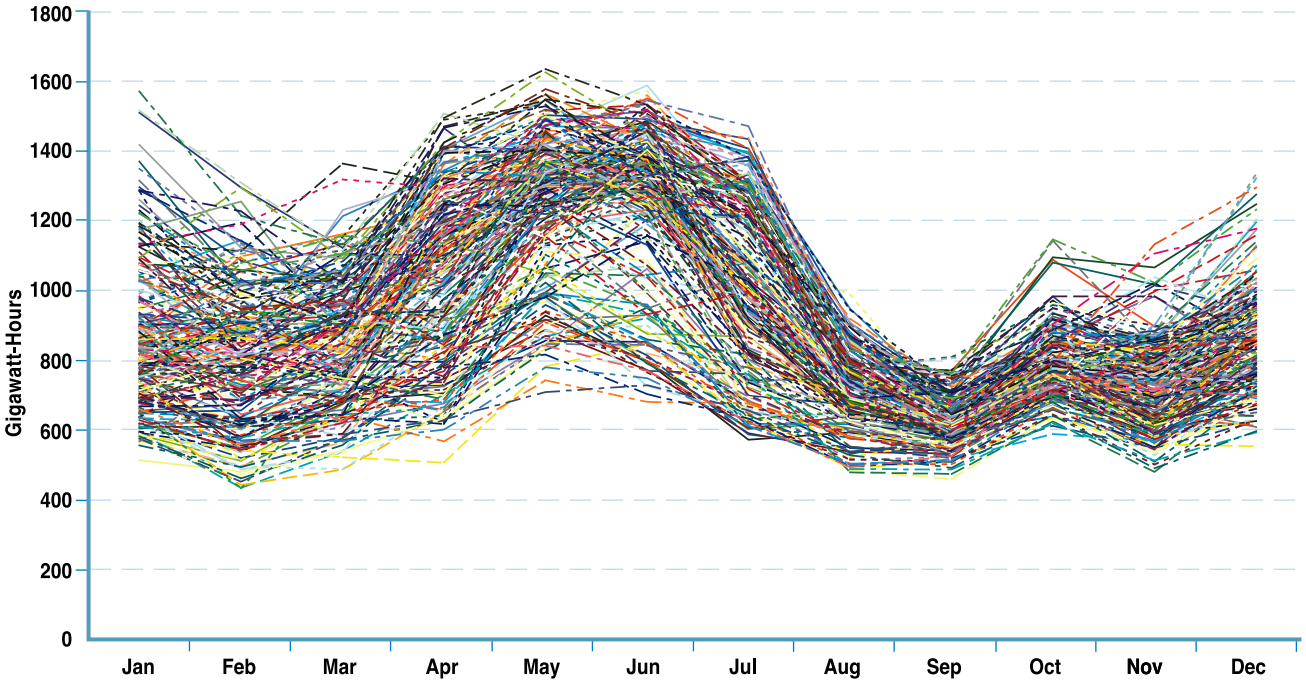
Existing Resource Portfolio

City Light's existing portfolio includes conservation, generation resources and market resources. City Light policy makers have been committed to conservation as the resource of first choice for over 30 years. Generation resources include low-cost City Light-owned hydroelectric projects, power purchased at preference rates from BPA, and contract purchases from other entities. The utility supplements these resources with power exchange agreements and purchases made in the wholesale power market. Much of City Light's power is generated by its own low-cost hydroelectric facilities, located mainly in Washington State. In 2002, City Light added wind power to its portfolio when it signed a 20-year contract to purchase output from the Stateline Wind Project in eastern Washington and Oregon.

Characteristics of the existing resource portfolio influence the choice of resource additions. The two dominant characteristics are hydro variability and monthly shape. The monthly shape of generation from the existing portfolio is not in synch with service area load. Load is highest in winter, but generation is highest in late spring. This suggests the use of strategies that in effect reshape generation to winter load. Properly constructed seasonal exchanges can accomplish this.

Hydro variability refers to the very broad range of generation capability determined by precipitation and can be very challenging to manage. The graph on the following page illustrates hydro variability, based on historical weather conditions and current river regulation. City Light must ensure that sufficient winter resources are available to provide the power needed by its customers under drought conditions, even when winter temperatures are very low. Conversely, the utility must also make the effort not to acquire too much surplus power, thus avoiding the risk of not being able to sell surplus power at prices that cover costs.

Hydro Generation Variability



Policy Direction

The policies that most affect City Light's Integrated Resource Plan are Washington state Initiative 937, the Seattle City Council Resolutions 30144 and 30359, and the Mayor's Climate Action Plan. Resolution 30144 (2000) and the Mayor's Climate Action Plan direct the utility to meet load growth with conservation and renewable resources. Resolution 30144 also directs City Light to mitigate greenhouse gas emissions from any fossil fuel use, and sets a long-term goal of "Net Zero" annual greenhouse gas emissions. City Light first achieved Net Zero in 2005 and has remained Net Zero.

The Greenhouse Gas Mitigation Strategy Resolution 30359 (2001) sets standards for calculating greenhouse gas emissions and mitigation projects. The climate change policy does not prohibit City Light from acquiring electricity from resources that produce greenhouse gas, but does require the utility to fully offset those emissions. Initiative 937 requires utilities with more than 25,000 customers to acquire cost-effective conservation and to serve load with increasing percentages of renewable power. The intent of the initiative is consistent with existing City policy, though specifics of the legislation will likely have an impact on the timing and exact amount of conservation and renewable resource acquisition. Seattle City Light's preferred resource strategy complies with the City's interpretation of the initiative.

The IRP contains a preliminary analysis of the potential impacts of climate change on hydro operations in the Pacific Northwest and for City Light. Various new research efforts are underway to analyze the impact of climate change on the region, most notably an effort at the University of Washington's Climate Impacts Group (CIG) to combine the latest versions of global climate models with new regional models and detailed sophisticated local watershed models. The results of this new work were not available for the 2008 IRP.

Using 2004 estimates of climate change impacts from the CIG and the Northwest Power and Conservation Council, City Light examined how its own hydro system and its power purchase agreements with other hydroelectric generators, most notably BPA, may be affected. The impacts to electricity demand from warming temperatures are also evaluated. With the limited downscaling data available at this time, City Light is only able to estimate partial financial impacts of climate change on its hydro system. However, this analysis has helped focus on a number of specific questions that will guide future efforts to better understand the impacts of climate change on operations. City Light continues to work with the CIG and

other climate change researchers to examine these questions and is hopeful that in future IRPs better information will be available at the watershed level.

The work to-date has provided a better understanding of the direction of local change than of the rate of change, and a better understanding of temperature changes than precipitation changes. The work has identified important information gaps in existing research. So far, the CIG analysis does not incorporate changes in glaciers and the impact of those changes on flows and water temperature. Further scientific research is needed on the pace of melting of North Cascade glaciers. The current research does not allow for predicting how potential impacts may change the habitat for critical species, like salmon and bull trout, which, in turn, may change how City Light and others manage watersheds to meeting federal and state stewardship responsibilities. Finally, the research does not predict the possible changes in the frequency of severe storms and flooding. All of these changes could affect protection of fish populations and hydroelectric generation potential, presenting additional uncertainties about the full impacts of climate change for City Light.

BPA and the Northwest Power and Conservation Council may pursue more detailed studies for the Columbia River System. City Light recommends further research on climate change impacts to the Columbia, Pend Oreille, and Skagit rivers as important hydroelectric resources for Seattle. City Light is working directly with CIG and the Lawrence Livermore National Lab, with the goal of having better information available for the next IRP.

Resource Choices

The three main categories of resources are conservation, generation and the wholesale power market. Generation resources can be further categorized as renewable and nonrenewable.

Conservation City policy guidance and State Initiative 937 require the acquisition of cost-effective conservation. Certain conservation measures can improve load shape because their greatest effect is in the winter when the weather is colder and nights longer, requiring greater electricity use. Conservation also has the benefit of avoiding transmission costs. Conservation as a resource was the mainstay in both rounds of portfolio analysis, which examined both constant and accelerated paces of acquisition.

Market The wholesale power market provides opportunities for seasonal exchanges and market purchases. Seasonal exchanges are low in cost and can help shape resources to load. Capacity contracts are useful for meeting a high demand that has a low probability of occurring. Both exchanges and capacity contracts are low cost ways to meet seasonal demand without the expense of acquiring new generation.

Renewable Generation Renewable resources satisfy the need for power and avoid air and water pollution that endangers the environment and human health. Renewable resources could become even more advantageous with the eventual imposition of a carbon tax.

Initiative 937 mandates the development of such resources. The availability of transmission could be a problem. The cost of transmission for wind resources is especially high because transmission must be available even when the wind is not blowing. Other renewable resources likely to be available in the near term to City Light are landfill gas and biomass.

Non-Renewable Generation Non-renewable resources are generally fossil fuels such as coal, oil and natural gas. Their emission of greenhouse gases and air pollutants has significant impacts on the environment and human health, and the necessity of mitigation makes them costly. Natural gas resources can be sited close to load and would require little in the way of transmission upgrades, while resources remote to load, such as coal, would require significant transmission, further increasing their cost.

Most fossil fuel resources have an advantageous generation profile that allows them to meet utility customers' base energy requirements and frees up the hydroelectric resources to follow load. The only fossil fuel resource that can effectively follow load is the natural gas simple cycle combustion turbine that can be used to meet peak load requirements or to operate during the hours proceeding the peak hour, thus saving hydro power to meet the peak requirements. Such a resource was examined.

Methodology for Analyzing Portfolios

The candidate portfolios were tested within the AURORAxmp® Electric Market Model developed by EPIS, Inc. City Light utilized forecasts of natural gas prices from Global Energy Decisions, Inc. (recently renamed "Ventyx") in its modeling. The Aurora model contains installed capacity and customer load in the Pacific Northwest electricity market, which is used to forecast electricity prices. The interplay of these four factors defines the power market in which City Light is likely to be operating over the next 20 years.

The Aurora model used for analyzing the portfolios simulated their operation based on the operating characteristics of each resource and its total cost, including fuel, operations and maintenance, and transmission. The amount of greenhouse gas emissions and air pollutants was also calculated. Costs were assigned to these emissions and considered along with other portfolio costs. At any particular point in time, the least-cost resource was picked first, followed by the next least-cost resource, and so on, until load for that point in time was met. The portfolios were then evaluated using the four criteria:

- Reliability. All portfolios were designed to meet the 95% resource adequacy measure for winter, but they vary in the degree of their reliance on total market purchases over 20 years.
- Cost. The net present value (NPV) of cash flows over 20 years for both capital and operating costs were calculated and compared.
- Risk. The sources of risk are uncertainty about hydro generation, level of demand, fuel prices and the market price of power, whether buying or selling. The portfolios varied in their exposure to these sources of uncertainty.
- Environmental impact. A thorough analysis of potential changes in environmental impacts from Round 2 resource portfolios was completed, and an update to the Environmental Impact Statement was prepared. Carbon dioxide emission impacts were assigned costs that were taken into account in the evaluation of each candidate resource portfolio. Total greenhouse gas and other air pollutant emissions over 20 years were calculated and compared for all portfolios. These included carbon dioxide, nitrogen oxides, sulfur dioxide, mercury and particulate.

Summary of Round 2 Portfolios
Net Present Value in Millions of Dollars

	Portfolios in Round 2	Net Power Cost	5% Chance of Higher Cost	Direct Emissions Cost	Overall Rank
P1	High Biomass, Geothermal	$188	$2,460	$2.1	2
P2	High Exchange, Geothermal, Biomass	$226	$2,470	$1.4	3
P3	High Wind, Geothermal	$214	$2,480	$1.4	4
P4	High Exchange, Wind, Geothermal	$331	$3,079	$0.9	5
P5	High Biomass, Geothermal, Wind	$201	$2,450	$1.6	1

In the 2006 IRP, City Light hypothesized that accelerating discretionary conservation might reduce the costs of complying with Initiative 937. The initiative requires purchases of eligible renewable energy as a fixed percentage of retail load. If the pace of acquiring conservation is accelerated, retail load is reduced, delaying the need for future resource additions. The necessary cost data to perform this analysis was unavailable. However, in the 2008 IRP, the update of the conservation resource potential assessment included the increased cost requirements for accelerating conservation. Despite these additional costs, accelerating conservation proved to be cost-effective on a societal basis, even without including non-energy benefits.

Key Findings and Conclusions

- To meet a 95% reliability standard for winter power supply, new resources are needed for 2009.

The IRP evaluates the challenges faced in maintaining reliability from a resource perspective (resource adequacy). A high degree of reliability is important because adequate electricity is needed to serve the economic activity, health, comfort and safety of the community.

A resource adequacy standard of having 95% confidence of meeting loads in any given January (the highest demand month) was established. This standard is defined in terms of "energy" requirements instead of "capacity" requirements because City Light's hydro system provides large amounts of capacity, but can run short of energy under sustained high demand conditions and low water.

The IRP team analyzed and modeled the hydro resources of the City Light hydro plants at Skagit and Boundary, hydro contracts with the Bonneville Power Administration, and other City Light hydro contracts. Year-to-year hydro generation can vary widely depending upon the amount of precipitation. In general, the West experienced less-than-normal precipitation and stream flows from 2001 until 2008. Higher levels of electricity demand that can occur with winter cold fronts also contribute to risk. The City Light system is most stressed by extended cold spells, when electricity demand for heating is highest.

The combined risks of low hydro generation and high winter demand are analyzed. The analysis indicates that under City Light's assumptions, the need for new resources will increase from 76 megawatts in the winter of 2008 to 544 megawatts in the winter of 2027. The existing need for resources in the out years is due to the combination of continued load growth and the expiration of power contracts in the existing portfolio.

- Seattle City Light can address an increasing proportion of energy demand by accelerating the pace of conservation.

As part of the 2008 IRP, conservation resource potential was re-assessed using more accurate costs for an accelerated pace of conservation. This assessment led to the conclusion that conservation acquisition activities can be accelerated while still attaining a high benefit-to-cost ratio on a societal cost basis, even without considering non-energy benefits. Accordingly, City Light staff began developing a comprehensive conservation 5-year plan to be released for public consideration in 2008.

- The seasonal balance of existing resources can be improved through increased seasonal exchanges with other utilities.

Resource needs are greatest in the winter months of November through February. January is the defining month for adequacy of resources, since this is when the winter peak demand usually occurs. The target amounts of energy to be acquired are driven by the January needs. At the same time, summer loads are substantially lower than in winter, due to Seattle's maritime climate.

City Light's lower summer loads provide an opportunity to conduct seasonal exchanges of power with electric utilities that have the reverse situation (higher loads in summer than in winter). The potential for City Light to conduct new seasonal exchanges is constrained by available electric transmission transfer capability and by reserves needed to assure sufficient resources for future summer loads.

In addition to seasonal exchanges, another opportunity exists for City Light to minimize the need to purchase or construct new resources. City Light can enter into capacity contracts with generators who have surplus generating capacity in winter months. Such capacity contracts serve to maintain a reserve, which can be called upon as needed. The delivery price of the power is pre-negotiated, so City Light would not be forced to pay exorbitant sums for purchased power if it takes delivery. Because the utility would rarely call upon this resource, it is a highly cost-effective alternative to building new resources or buying power under long-term contracts to ensure reliability.

- Reliability can be ensured for the next four years with a strategy of accelerated conservation, exchanges and the acquisition of a small new renewable resource.

A 95% probability of being able to meet the highest winter loads can be ensured for the next four years with the acquisition of less than 10 average megawatts of new generating resources. However, this requires other measures in the plan to be fully implemented on schedule, without fail.

This approach has relatively low costs.

- The preferred portfolio meets Initiative 937 requirements for conservation and renewable energy.

The preferred resource portfolio, complies with all future conservation and renewable resource requirements for Initiative 937. In the early years of the plan, existing resources will be used more efficiently through new cost-effective conservation, seasonal exchanges with other utilities and the seasonal capacity contracts described above. When City Light has exhausted the potential to improve the seasonal balance between supply and demand, renewable resources will be added in relatively small increments to meet the targeted reliability requirement.

Recommended Resource Portfolio (Average Megawatts)

Resource	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Accel. Conservation	10	22	37	52	68	84	97	110	122	135	146	149	152	153	154	155	156	157	158	159
Capacity Purchase	20											10								5
Exchange 1	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Exchange 2		55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55	55
Gorge Tunnel II								5	5	5	5	5	5	5	5	5	5	5	5	5
Landfill Gas		6	6	9	9	11	11	14	14	16	16	18	18	21	21	21	21	21	21	21
Geothermal						45	45	45	45	45	45	45	125	125	15	125	125	125	125	125
Wind																	85	85	85	85
Biomass											40	40	40	40	40	40	40	40	40	40
Total	80	134	148	166	182	245	258	278	291	306	357	373	446	449	450	451	537	538	539	545

The first generating resource addition in the recommended portfolio is 6 MW of landfill gas in 2009. Landfill gas grows to over 20 MW by 2027. The second is geothermal energy added at 45 MW in 2013. The geothermal resource is also scaled up during the planning period, so by the end of 2027 there is 125 MW of geothermal capacity. A 40 MW biomass resource is added in 2018, followed by 85 aMW of wind in 2024.

The Integrated Resource Plan was constructed using practices common throughout the electric utility industry. The recommended portfolio provides balance of reliability, cost, environmental impact and risk. It is flexible and cost-conscious. It seeks to get the most from existing resources before looking to new resources. The recommended portfolio will be re-evaluated for the 2010 IRP and can be adjusted if needed before large purchases of new resources are necessary.

- Another IRP will be completed by the end of 2010, allowing for more study of resource needs and options for supplying needs.

Energy markets are dynamic and volatile. Changes in supply, demand, resource technologies and costs are inevitable. Resource plans must be flexible and should be routinely updated for new information to stay relevant and useful. City Light's IRP is formally updated every two years, with substantial public input. A plan is filed bi-annually with the Washington Community, Trade, and Economic Development Department. However, work on improving the resource plan is ongoing at City Light.

The 2008 IRP includes short-term actions to begin implementing the long-term strategy. This action plan is among the most important outcomes of the planning process. These actions will pave the way for improving the seasonal balance of existing resources, acquiring new resources in the future and improving information and analytical capabilities developed during the 2008 IRP.

IRP Action Plan, 2008-2009

Actions	2008	2009
Conservation Resources		
Pursue accelerated conservation in the targeted amounts	8.4 aMW by end of 4th Qtr	12 aMW by end of 4th Qtr
Generation Resources		
Pursue full BPA contract rights	Finalize negotiations and elections for 2011	
Complete a power purchase agreement with a landfill gas supplier by mid-2009	Negotiate contract by end of 4th quarter.	Plant to begin construction and testing.
Investigate future capacity versus energy needs as the region grows shorter on capacity	Begin data collection	Complete analysis in time for 2010 IRP
Market Resources		
Investigate and acquire seasonal exchanges and/or capacity contracts to offset near-term reliability risk	Additional 50 aMW as needed	Additional 50 aMW as needed
Other New Resources		
Evaluate results of the distributed generation market study and pursue any cost-effective opportunities with customers	Engage in discussions with appropriate customers by year end	Decision on go or no go with appropriate customers by 2010
Collect and update information on costs of a wide range of new resources commercially available by June 2008	Ongoing	Ongoing
Continue investigating the development status, costs and commercial availability for geothermal, solar, and demand response. Acquire these resources as appropriate	Ongoing	Select technologies for inclusion in 2010 IRP.
Transmission		
Continue to participate in and support the development of Columbia Grid	Ongoing	Ongoing
Provide comments to the U.S. Department of Energy and Federal Energy Regulatory Commission on transmission issues of importance to City Light	Ongoing	Ongoing
Future IRPs		
Continue to refine assumptions, forecasts and modeling	Ongoing	Ongoing
Support research on the impacts of climate change to North Cascade glaciers and water temperatures in the Skagit, Pend Oreille, and Columbia Rivers	Ongoing	Ongoing