

Chapter 2 – Existing Resources

This chapter describes City Light's existing resources and its power supply. Also described is the resource adequacy standard, the primary driver of the Integrated Resource Plan.

Seattle City Light uses a combination of resources to meet its power needs. The utility's current resource portfolio includes conservation, owned generation resources and long-term contract resources, supplemented with power exchange agreements and near-term purchases made in the wholesale power market. In 2002, City Light augmented its portfolio with a contract for the purchase of power from the Stateline Wind Project, a renewable energy resource. City Light depends primarily on Bonneville Power Administration (BPA) for electric transmission to its service area.

The following sections discuss existing conservation, generation and market resources City Light uses to meet its customers' power demand.

Conservation

Seattle City Light meets the power needs for its service area with a high degree of reliability. Conservation was introduced into the resource mix over 30 years ago and has remained the resource of first choice for the utility to meet load growth. The conservation partnership between the utility and its customers has successfully deferred acquisition of expensive new resources, especially those that negatively affect the environment.

Chapter 3 provides information about conservation policy and legislation that guides City Light in its conservation programming. Chapter 4 focuses on the assessment of future conservation resource potential for the 2008 IRP.

As the Pacific Northwest moves from a period of energy surplus to deficit, conservation programs will continue to encourage customers to use power more efficiently and to defer the acquisition and expense of new resources. Conservation is low-cost and has low environmental impacts, including no greenhouse gas emissions. It is integral to Seattle City Light's Integrated Resource Plan, the Mayor's Climate Action Now Campaign, and to meeting the requirements of I-937. It has also been good policy in a transforming energy market because it reduces price risk and availability risk.

Programs are designed for all customer classes: residential, commercial, and industrial. Conservation programs address specific energy end-uses such as efficient lighting, water heaters and laundry appliances, HVAC, motors and manufacturing equipment, and encourage weatherization and high-efficiency construction methods. Monetary incentives to utility customers include rebates, loans or outright purchase of savings for installed energy efficient measures.

Energy Saved by Conservation Programs

From 1977 through 2007, City Light's conservation programs saved over 10 million megawatt-hours by increasing the efficiency of electricity use in Seattle homes, businesses and industries. Ten years ago, the average Seattle City Light residential customer used 10,739 kilowatt-hours of electricity per year, 500 kilowatt-hours more than the national average. Today, the average City Light residential customer uses 8785 kilowatt-hours, about 1000 kilowatt-hours fewer than the national average.

Seattle City Light's new conservation measures saved about 7 average megawatts of power in 2007. Credit for avoided transmission and distribution losses and savings from participation in the regional market transformation efforts of the Northwest Energy Efficiency Alliance boosted the total savings for the year to about 75,000 MWhs. These savings prevented 45,000 tons of carbon dioxide emissions from entering the atmosphere, which is roughly equivalent to removing 10,000 automobiles from Seattle streets.

Conservation programs at City Light underwent a comprehensive analysis in 2007, when utility conservation staff teamed with conservation experts from Energy Market Innovations, who provided project management and subject-matter expertise. The result of this collaboration is a plan to incorporate conservation industry best practices as the utility strives to meet much of its load growth through conservation measures.

Generation Resources

Over 90% of City Light’s power is generated by hydropower, including its own low-cost hydroelectric facilities mostly located in Washington state. As a municipal utility, City Light enjoys preferential status in contracting for the purchase of additional low-cost power that the Bonneville Power

Administration (BPA) markets. The utility has contracts with several other owners of hydroelectric projects in the region. In 2002, City Light signed a 20-year contract with the Stateline Wind Project. These resources and their locations are shown on the map below. See Table 2.1, following the descriptions of City Light resources, for the amounts generated by City Light resources over the period 1999-2007.

Figure 2-1. Seattle City Light’s Generation Resources



City Light Resources

Boundary Dam is City Light’s largest resource with a peaking capability of 1055 MW and average generation of about 490 aMW annually. Under the Federal Energy Regulatory Commission (FERC) license, part of Boundary output must be sold to Pend Oreille County Public Utility District No. 1 to meet the PUD’s load growth. In addition, about 5 aMW of energy must be delivered to the PUD in compensation for Boundary Project’s encroachment on its Box Canyon Dam.

Energy from Boundary is wheeled to consumers over BPA’s transmission grid.

Skagit Project includes the Ross, Diablo and Gorge projects, which have a combined one-hour peak capability of 690 MW. City Light transmission lines carry the power generated from the Skagit Project to Seattle

Newhalem is located on Newhalem Creek, a tributary of the Skagit River. City Light-owned transmission lines deliver its two megawatts of power.

South Fork of the Tolt has a one-hour peaking capability of less than 17 MW. Project costs are offset by BPA billing credits. Power from this project is delivered over a line owned by Puget Sound Energy.

Cedar Falls dam has capacity of 30 MW. Power is transmitted by Puget Sound Energy.

Contracted Resources

Bonneville Power Administration City Light's largest power purchase contract is with BPA. The contract allows the utility to receive power from 29 hydroelectric projects and several thermal and renewable projects in the Pacific Northwest. A Block and Slice Power Sales Agreement with BPA allows City Light to purchase over a 10-year period, beginning October 1, 2001. Energy is delivered through BPA's transmission grid.

Under the contract, power is delivered in two forms: a shaped Block and a Slice. Through the Block product, power is delivered in monthly amounts shaped to City Light's monthly net requirement, defined as the difference between City Light's projected monthly load and the resources available to serve that load under critical water conditions. Under the Slice product, City Light receives a fixed percentage of the actual output of the federal system and pays the same percentage of the actual costs of the system. Power available under the Slice product varies with water conditions, federal generating capabilities, and requirements for fish and wildlife protection and restoration.

City Light is scheduled to sign a new 20-year contract with BPA by October 2011. BPA is involved in structuring contracts that will fairly apportion its least expensive base system generation among its customers. All other BPA power will be available as variously designed products. Power will be sold primarily at two rate levels - one for the base system generation and the other, a market rate for power from other resources. Decisions affecting the marketing of BPA power can significantly affect City Light's resource portfolio cost, risk and reliability.

High Ross Agreement In an 80-year agreement with the Canadian Province of British Columbia, City Light abandoned plans to raise the height of Ross Dam in exchange for power purchases from British Columbia Hydro (Powerex). Power delivery and price is similar to the generation and costs City

Light would have experienced had construction taken place. Through 2020, the power City Light receives from the contract has a relatively high cost. In 2020, the cost reduces to a few dollars per MWh because the cost portion, equivalent to debt service that would have been issued to build the High Ross Dam, will terminate. BPA delivers the power over their transmission lines.

Lucky Peak Because of its location near Boise, Idaho, Lucky Peak can sell power to all major western trading hubs (Mid-C, COB, PV, Mead, and Four Corners) without encountering normal transmission constraints. City Light has the option to sell to the highest market. City Light has contract rights to Lucky Peak's power for about 30 more years.

Priest Rapids Project City Light purchases power from this project under a 2002 agreement with Grant PUD, who owns and operates the project. Seventy percent of Priest Rapids Project's output has been allocated to Grant PUD, and City Light's share is expected to be about two to three average megawatts in 2008-2009, with a small increase in 2010, followed by gradual reduction as Grant PUD's load increases.

Grand Coulee Project Hydroelectric Authority City Light has 40-year contracts to buy half of the output, or about 27 aMW, from five Columbia River Basin hydroelectric projects. City Light's contracts expire over the period 2022-2027. Electric generation is mainly in the summer months and is transmitted to Seattle by local entities and BPA.

Northern California Power Agency Under its exchange agreement with the Northern California Power Agency (NCPA), City Light delivers 60 MW of capacity and 90,580 MWh of energy to NCPA in the summer. In return, NCPA delivers 46 MW of capacity and 108,696 MWh of energy to City Light in the winter. Deliveries to NCPA started in 1995 and will continue until the agreement is terminated.

Stateline Wind Project City Light has an agreement with Iberdrola to purchase wind energy and associated environmental attributes from the Stateline Wind Project on the Washington and Oregon border. City Light receives wind energy with an aggregate maximum delivery rate of 175 MW per hour through December 2021. Energy delivered under the contract is expected to average about 45 aMW. City Light has also entered into an agreement through 2011 to purchase integration and exchange services from PacifiCorp.

Burlington Biomass Facility City Light has a 10-year power contract (2007-2016) with Sacramento Municipal Utility District (SMUD) to deliver 15 MW of the output of a 23 MW capacity biomass generating plant (Sierra Pacific Industries' sawmill and co-generation plant in Burlington, Washington) to the California-Oregon border. City Light purchases energy and environmental attributes equal to the difference between the plant output and the 15 MW SMUD delivery obligation. The amount is expected to average about 3 MW over the course of the year. City Light will also receive energy from SMUD from unspecified resources during December, January, and February, in exchange for City Light's delivery service.

Power from Existing Generation Resources

Table 2-1 shows the recent history of annual power production from each of the generation resources described above, as well as some no longer part of City Light's portfolio. The table demonstrates how the portfolio has changed in recent years and illustrates power production variability caused by weather.

Table 2-1. Power Generated Annually from Existing Resources in Average Megawatts

	1999	2000	2001	2002	2003	2004	2005	2006	2007
OWNED GENERATION									
Boundary	508.1	431.7	267.1	452.2	408.1	398.8	395.1	493.1	414.6
Skagit - Gorge	135.4	109.3	70.4	117.0	106.3	105.2	88.7	99.6	122.9
Skagit - Diablo	116.7	92.7	54.5	102.8	84.9	8.5	74.8	85.1	95.3
Skagit - Ross	109.9	84.4	44.9	95.6	83.1	77.6	64.3	73.2	98.1
Newhalem		0.4	1.1	1.1	0.9	1.4	0.7	1.0	0.6
South Fork Tolt	8.0	5.0	4.6	8.9	5.6	6.9	5.1	6.1	6.4
Cedar Falls	8.1	5.7	7.4	9.1	7.3	7.0	4.2	8.6	7.6
Centralia (sold 2000)	78.7	31.5							
TOTAL OWNED GENERATION	965.1	760.8	449.9	786.7	696.2	685.3	633.0	766.7	745.5
PURCHASE CONTRACTS									
Bonneville Power Administration	180.6	193.7							
Bonneville Power Administration Block			200.7	152.3	147.1	137.8	109.4	174.4	242.2
Bonneville Power Administration Slice			71.5	322.4	390.9	392.8	385.1	451.1	411.3
High Ross (B.C. Hydro)	35.2	33.8	5.1	33.9	36.0	34.8	35.4	36.1	35.8
Boundary Encroachment (BC Hydro)	1.7	2.0	0.9	1.2	1.6	1.5	1.7	2.6	1.9
Lucky Peak	48.6	38.8	21.5	33.0	33.4	31.3	25.8	46.5	31.2
Priest Rapids (Grant County PUD)	47.1	41.4	29.9	37.3	35.5	36.0	32.9	2.8	2.9
Grand Coulee Project Hydroelectric Authority	28.6	27.2	30.9	28.3	26.9	28.9	28.5	27.6	29.1
Stateline Wind				12.2	24.7	39.7	37.4	43.9	44.0
Klamath Falls (expired 2006)			37.2	81.0	74.7	81.8	66.4	11.4	
Pend Oreille PUD (expired 2005)	8.1	6.6	4.9	5.0	5.4	6.7	3.0		
Metro CoGeneration (expired 2004)	0.9	0.8	1.4	1.7	1.6	0.7			
Columbia Storage Power Exchange (expired 2003)	16.1	12.1	11.6	11.3	3.0				
TOTAL PURCHASE CONTRACTS	366.9	356.5	445.8	719.5	780.8	792.0	725.6	796.4	798.4

Since City Light's current resource portfolio is over 90% hydro, its hydro storage capability has the advantage of operational flexibility but the disadvantage of being significantly affected by weather conditions. The amount of water available for power generation is affected by the amount and the timing of precipitation, run-off from snow melt, and regulations governing the recreational use of lakes, irrigation, protection of fish habitat and other environmental concerns.

Operational flexibility allows the utility to meet peak load easily most of the time, but the ability to serve peak load can be greatly diminished when water levels are low. Prior to 2006, the West experienced six consecutive years of drought conditions, with 2001 as the most severe. Thus, City Light's resource portfolio must be able to serve load under prolonged drought conditions that do occur in the region.

As shown in Table 2-1, the amount of power produced from owned generation in 1999 was about twice the amount produced in 2001, illustrating the risks associated with hydropower production. To make up the shortfall in 2001, City Light increased its purchases from Bonneville Power Administration (BPA), but was still forced to make purchases from the market. By 2002, City Light had signed a new contract with BPA that nearly doubled its purchases. Wind power from Stateline came online in 2002, and power from that source increased over the next two years to its current level.

Future Outlook for Current Generation Resources

Over the next 20 years, not all of the generation resources described above will remain as they are in the existing portfolio. City Light's license to operate Boundary Dam expires in 2011, but with Boundary's relicensing process underway, the utility is confident of the license's renewal. Some contracts will expire or be modified over the planning period. The Stateline wind contract that provides for about 45 aMW expires in December 2021. City Light's share of Priest Rapids generation output gradually declines over the 20-year planning horizon at the rate of Grant County PUD's load growth. City Light's contracts with the Grand Coulee Project Hydroelectric Authority begin to expire in 2022.

Possible changes in the BPA contract have a potentially greater impact. City Light's current power contract with BPA expires in 2011. A new 20-year contract is scheduled to be in place in October 2011. Features of new contracts between BPA and its clients are currently under discussion. The 2008 IRP assumes City Light will continue to purchase power from BPA near present levels after 2011.

BPA has developed a new policy (Long-Term Regional Dialogue record of decision) to address the Pacific Northwest utilities desire to restore and protect low-cost regional power for the post-2011 power contracts. This new policy describes what the new 20-year contracts will look like and how power purchases under the contracts should be priced. As of March 2008, BPA proposed that new long-term contracts be signed in late 2008 for service that begins in October 2011 and terminates in November 2028.

BPA's new policy will include a two-tier pricing system. Tier 1 priced power will be based on the cost of the existing Federal Base System resources. Tier 2 priced power will be based upon either the actual or marginal price of new resources. The amount of power priced at Tier 1 (High Water Mark) that a public power customer will be eligible to purchase will be equivalent to the customer's actual 2010 loads placed upon BPA. To the extent a public power customer is eligible to place loads on BPA above the quantity it may purchase at the Tier 1 price, the customer will be required to purchase such power at the Tier 2 price. Many uncertainties remain with respect to the quantity of power (High Water Mark) that Seattle will be eligible to purchase, the price for Tier 1 power, and the price for Tier 2 power.

In the future, the resource portfolio will include more renewable resources, consistent with policy direction from the City Council (Resolution 30144) and Initiative 937. The accelerated conservation resource will also have a substantial impact as City Light continues to fund programmatic conservation.

Market Resources

The wholesale electric power market in western North America plays an important role in meeting Seattle's power needs by balancing City Light's energy surpluses and shortages.

Surplus power can be sold and power shortages can be made up with purchases both seasonally and over a period of years. Power can also be obtained from the wholesale market through seasonal capacity contracts, although City Light currently has no such contracts. (See Chapter 4 for potential use of market resources in the IRP.) In order to ensure winter reliability, the 2008 IRP allows a maximum of 100 aMW of energy to be purchased in the wholesale power market to meet short-term winter needs. Any needs above 100 aMW in the plan must be met by new conservation and new firm resources.

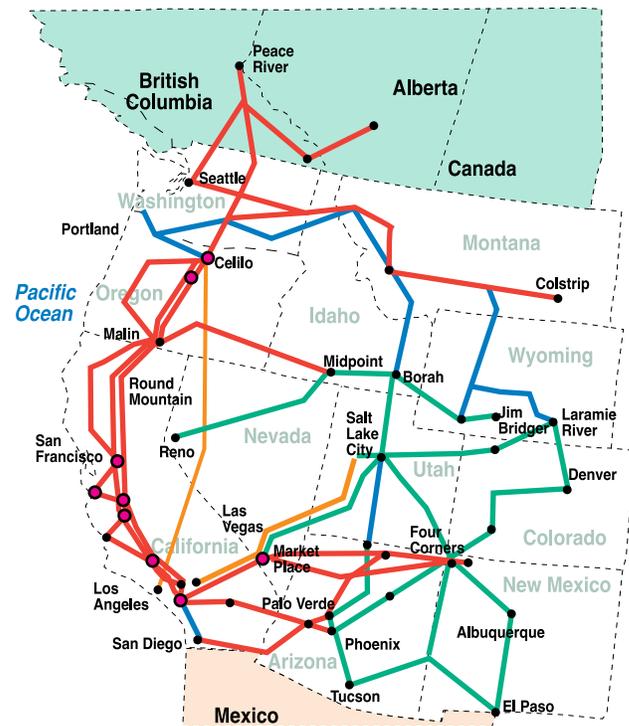
With colder winter temperatures driving Seattle's power demand to peak in November through February and the spring snow melt driving hydropower production to peak in April to June, a seasonal mismatch exists between demand and supply of power. Keeping sufficient power generation capability to meet winter demand leads to excess generation capability the rest of the year. In addition to seasonal variation in supply and demand, precipitation may vary substantially from year to year, making it difficult to predict the supply of hydropower.

City Light actively manages its portfolio of power supply resources by purchasing and selling power in the wholesale markets and transacting seasonal exchanges of power. These transactions lower the rates charged to the utility's retail customers by generating revenues from sales of surplus energy and allowing purchases of lower cost power.

Western States Transmission System

The Western electric transmission system physically defines the wholesale market for electricity in western North America. This market is broadly made up of 11 western states, two Canadian provinces, and northern Baja California, Mexico, as shown in Figure 2-2.

Figure 2-2. Western Electric Transmission System



Constructed primarily in the 1950s and 1960s, the high-voltage transmission system is owned by a number of both private and public utilities. In the Pacific Northwest, the Bonneville Power Administration (BPA) operates about 75% of the transmission system, with other large transmission owner/operators, including PacifiCorp, Puget Sound Energy, Avista, Idaho Power, British Columbia Transmission Company and Portland General Electric, operating the rest. The high voltage transmission system is near capacity in many parts of the West, including the Pacific Northwest.

Market transactions are facilitated by City Light's ownership share of transmission capacity rights on the Third AC Intertie. This ownership share was acquired in 1994, when City Light signed an agreement with BPA for rights to 160 MW of transmission capability over BPA's share of the Third AC Intertie. The Third AC Intertie is an alternating current line that connects the Northwest region with California and the Southwest.

Resource Adequacy

An electric utility's ability to meet its customers' energy requirements is called resource adequacy. The 2008 IRP's essential purpose is to meet City Light's resource adequacy target for the 20 year planning horizon. In addressing this purpose, the IRP team sought a high level of probability that load will be served without acquiring expensive resources that will not be needed.

In the Pacific Northwest, the regional capacity planning reserve margin is typically above 20% because of the high degree of variability in hydro resource, both seasonally and annually. Four regional organizations have estimated regional resource adequacy and have arrived at different conclusions based on differences in their measures and assumptions, including such items as the amount of power available from outside the region and the amount of hydro flexibility in the region's hydroelectric system.

The regional view that power supply is tightening coincides with City Light's perception and experience. City Light is somewhat insulated from the planning risk of a tighter regional market by its assumption of limited availability of energy from the market under critical conditions. The 2008 IRP assumes that 100 aMW of electricity will be available for City Light to purchase in the market under the most extreme temperatures and shortage conditions of the planning period.

While there are concerns about summer resource adequacy for the Northwest region as a whole, City Light has more than adequate summer resources, and its focus is on winter resource adequacy. City Light's peak demand occurs typically in January. To enhance reliability in the winter months at very low cost to the utility, City Light has proposed increasing summer-for-winter energy exchanges. For the 2008 IRP, City Light used an energy resource adequacy measure as opposed to a capacity resource adequacy measure. This is because City Light's existing resource portfolio is 90% hydropower. For up to several days, City Light has substantial amounts of generation capacity available. The larger risk is running out of water, or in City Light's case, "energy." Hence the focus is on an energy resource adequacy standard.

City Light has experienced a wide range of water conditions over 50 years and has that record upon which to make assumptions. As mentioned above, City Light's peak demand typically occurs in January. The years of lowest water conditions for January have been 1978, 1937 and 1944. However, City Light restates the historical record of water conditions in order to accommodate the effects that regulations have on City Light water resources for public and environmental purposes: preservation of fish populations, irrigation, flood control, and recreational use.

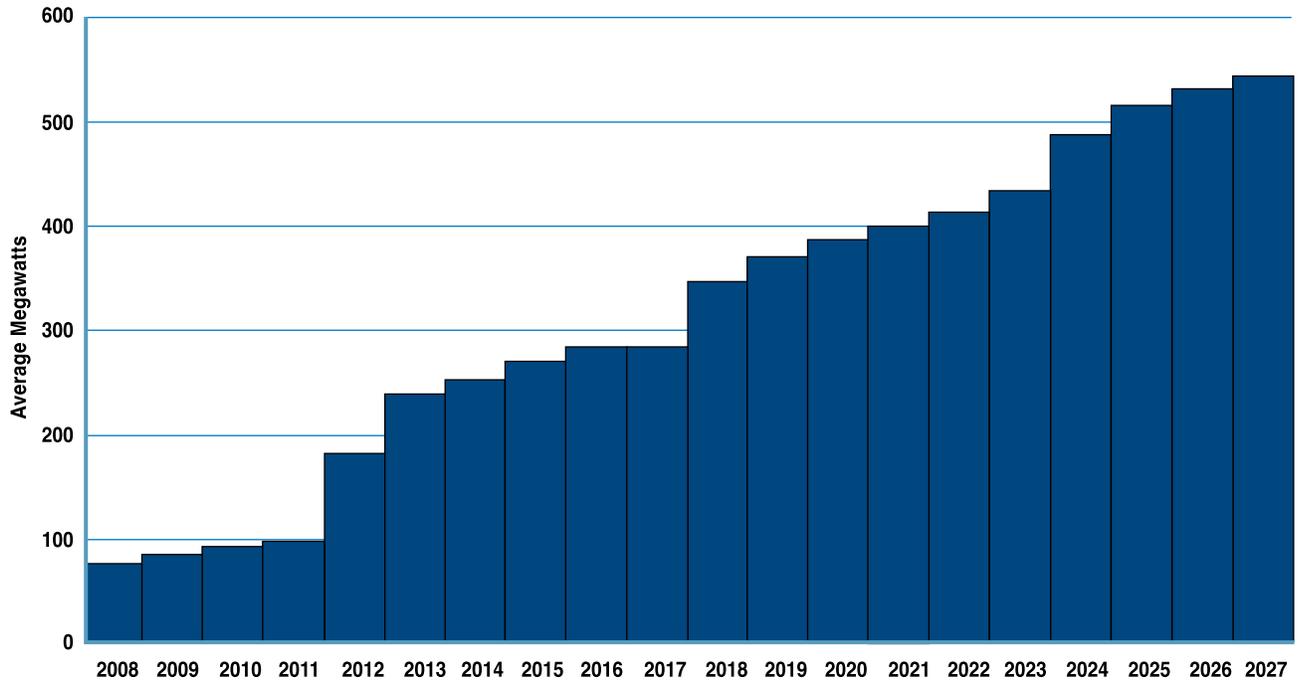
After evaluating several methods of calculating resource adequacy, City Light elected to use the 5th percentile (lower tail of the distribution) of hydropower generation for integrated resource planning in 2008. The level of reliability selected for the 2006 IRP with stakeholder and public input was 95% confidence of no unserved energy (5th percentile). This is the average of the second and third worst water years of record. The utility assumes the risk that on average, it could potentially be short of power once in 20 years. Applying the lowest 5th percentile of hydropower generation in the model provided an estimate of unavailable energy that would be needed to supply demand on an hourly basis for January of each year. This amount was reduced by the assumption that 100 aMW, as mentioned above, could be purchased from the market in every hour.

In producing targeted resource additions, these factors were considered:

- The 1 in 2 (50:50) one-hour peak demand forecast for City Light
- The lowest 5th percentile of hydropower generation
- Assumptions about continuing operation of existing resources (e.g. Boundary relicensing, BPA contract renewal)
- Expiration of existing contracts on schedule
- The need for new renewable resources to meet the requirements of the Washington Energy Independence Act (I-937)

These considerations led to the estimated resource requirements by year shown in Figure 2-3.

Figure 2-3. New Resources for Winter Resource Adequacy



New Resources to Meet Resource Adequacy

Over the 20-year planning period, load is expected to continue to grow as some of the power purchase contracts expire. The amount of load not served at the 95% level increases as the difference between load and resources grows. The resource adequacy requirement is calculated to account for the risk of variation in hydro generation and loads, and to replace the resources of expired contracts. After the Stateline Wind contract expires in 2021, resources are estimated to be insufficient in late summer and early fall, as well as in winter. In order to reduce the risk of unserved energy demand below

the 5% level, approximately 76 aMW of additional energy must be available in 2008. As load increases through the 20-year planning period, the amount of additional resources required grows to 544 aMW by the year 2027.

The resource adequacy study was the starting point for developing a portfolio of additional resources for the 20 years from 2008 to 2027. As described in Chapter 6, new resources, including conservation, were added to the existing portfolio, in amounts and at points in time when the resource adequacy study indicated they would be needed. This methodology produced candidate portfolios that each met the same level of resource adequacy.