

## Chapter 5

# DESCRIPTION OF RESOURCES

### Resource Descriptions

The resources examined and presented in the 2009 Plan represent a set of plausible electric generation resource options for future inclusion in the Supply portfolio. NorthWestern has narrowed its focus to include technologies that are both proven and commercially available for deployment and resources that are under development including resources that may employ carbon mitigation. For the resource types that are proven and available for commercial operation, the list of possibilities has been narrowed to include those technologies that could meet customer and utility needs in terms of size, cost, and production characteristics. NorthWestern selected resources for evaluation and inclusion in the Plan in conjunction with Electric Technical Advisory Council (ETAC) review and input. NorthWestern also reviewed other northwest utility planning documents, the Council's 6th Power Plan, and other sources. Volume 3 includes materials presented by NorthWestern to ETAC including preliminary modeling results that are, in part, the basis for the selection of technologies employed in the Plan.

Not all resources considered in the 2007 Plan have been included in the 2009 Plan. Some resources evaluated in prior plans have not achieved commercial-scale deployment or demonstrated development in Montana. Developers have offered only a limited number of technology types, primarily wind, woody biomass, and small hydro in response to renewable solicitations conducted in Montana over the past several years. Technologies such as compressed air storage, pumped storage, hydro, and geothermal require site specific conditions and considerable pre-development study to establish technical feasibility before their economic viability can be assessed. If offered to NorthWestern in the future, NorthWestern would carefully consider these and other resources for inclusion in the Supply portfolio based on their ability to provide value to the Supply portfolio. Exclusion of these resource types does not preclude development. It simply means that the inclusion of these resources in the analysis at this

time provides little value. NorthWestern cannot assess these technologies until proposals that identify specific projects are brought to the utility for consideration.

Finally, some resources have been eliminated from modeling simply because of their size and a limited ability to influence portfolio cost or other resource decisions. In these cases, small distributed generation technologies that may prove viable in the future will be considered by NorthWestern on a case by case basis when and if they are presented to the utility either through RFP solicitations or through unsolicited offers from developers. NorthWestern and its predecessor Montana Power have had experience with technologies such as solar, micro-turbines, fuel cells, batteries, flywheel energy storage, and others. These technologies have not yet achieved widespread commercial application within the NorthWestern service territory and thus, do not yet influence larger resource decisions; particularly in the short-term. However, NorthWestern maintains an ongoing interest in building a diversified portfolio; particularly for energy sources with desirable energy output characteristics that provide value to the supply portfolio. The fact that NorthWestern has not modeled a specific resource type does not mean that it would not be considered in the future.

The 2009 Plan considers new generation and market opportunities as the principle sources of resource additions to the existing Supply portfolio. If opportunities for participation in existing facilities were to materialize in the future, NorthWestern would only evaluate and bring forward those opportunities after careful consideration and analysis to determine if such an opportunity could add value in terms of portfolio cost, risk mitigation or both.

NorthWestern has considered the addition of thermal technologies in the 2009 Plan through the portfolio modeling process. Additional descriptions of the individual units, costs, and performance defined and analyzed in the Plan can be found in Volume 3. It is important to note that the Plan resources, other than the existing projects, represent generic resources. None of the generic projects have been sited or undergone detailed engineering analysis to determine actual operational and economic performance. Additional, detailed work will be required prior to any firm commitment on the part of NorthWestern and stakeholders to move forward with resource

acquisition and development. Resources that include a “CCS” designation are those that have been evaluated including carbon capture and sequestration technology that is being evaluated and developed for future commercial application.

### **Generating Technologies**

In this 2009 Procurement Plan, after the considerations explained above, the following potential new resources were submitted for portfolio construction and analysis:

#### **New Renewable Resources**

- Wind sized at 10, 15, and 25 MWs
- Woody Biomass<sup>1</sup>

#### **New Thermal Resources – Natural Gas and Petroleum**

- Internal Combustion Engines
- Single-Cycle Combustion Turbines (“SCCT”) Frame Series engines
- SCCT units - LM6000
- SCCT units - aero-derivative
- Combined-Cycle Combustion Turbines (“CCCT”) combining a SCCT Frame engine with a heat recovery unit steam-cycle generator.
- CCCT with Carbon Capture and Sequestration (“CCS”)
- Combined Heat and Power (“CHP”), combining a CCCT with an industrial process that utilized waste heat and steam directly in their industrial processes.

#### **New Thermal Resources – Coal**

- Coal - Supercritical
- Coal – Supercritical with CCS
- Coal Integrated Gasification Combined Cycle (IGCC)
- Coal IGCC with CCS

### **Resource Costs**

Cost and performance data used in the 2009 Plan for new resources have primarily been developed from public sources. These sources include the NWPCC 6<sup>th</sup> Power Plan, other utility IRPs, US government publications, and other sources. This level of information has proven adequate for the purpose of long-term planning and comparing resources. Table 22 provides a summary overview of the thermal resource costs and heat rates that have been evaluated in the 2009 Plan. Information about the data compiled and collected for generation resources has been tabulated and presented in Volume 3 Chapter 5.

Table 22

**Resource Cost Summary  
\$2009**

<i>Fuel Source</i>	<i>Technology</i>	<i>Capacity per Unit (MW)</i>	<i>Capital Cost \$ / kW</i>	<i>Fixed O&amp;M \$ / kW-yr</i>	<i>Variable O&amp;M \$ / MWh</i>	<i>Heat Rate Btu / kWh</i>
Wood Products	Biomass	25	\$3,709	\$71.55	\$4.82	12,974
Coal	IGCC	300	\$3,938	\$46.54	\$4.39	8,592
Coal	IGCC w/ CCS	300	\$5,503	\$57.33	\$7.36	10,266
Coal	Supercritical	200	\$3,755	\$40.90	\$3.27	9,093
Coal	Supercritical w/ CCS	200	\$5,821	\$94.69	\$6.56	12,561
Natural Gas	CHP	200	\$1,305	\$2.57	\$5.99	7,604
Natural Gas	CCCT	200	\$1,248	\$12.10	\$2.70	6,916
Natural Gas	CCCT w/ CCS	200	\$2,470	\$35.07	\$4.27	8,424
Natural Gas	Internal Combustion	22	\$1,093	\$39.75	\$5.17	8,826
Natural Gas	SCCT LM6000	40	\$1,089	\$9.38	\$4.31	9,361
Natural Gas	SCCT Aero	100	\$965	\$3.35	\$3.59	8,842
Natural Gas	SCCT Frame	100	\$593	\$4.02	\$3.21	10,955
Natural Gas	CC-207EA <sup>1</sup>	222	\$1,035	\$12.10	\$2.70	8,388
Natural Gas	CC-LM6000PF <sup>2</sup>	102	\$1,367	\$12.10	\$2.70	7,468

<sup>1</sup> Capacity and heat rate exclude duct firing. With duct firing capacity increases to 284MW and heat rate increases to 9,288.  
<sup>2</sup> Capacity and heat rate exclude duct firing. With duct firing capacity increases to 120MW and heat rate increases to 8,368.

**New Thermal Resource: Internal Combustion Engines**

Internal Combustion Engines, also known as “IC” units, “reciprocating engines”, or “recips” employ the equivalent of very large truck engines designed to generate electricity using either natural gas or diesel as a fuel source. The units typically enjoy a relatively low installation cost, but require significant on-going maintenance expenditures and a somewhat high heat rate - on the order of 9,000 Btu/kWh. The benefits of IC units include rapid installation, good performance at higher altitudes, and good regulating capability. In addition, the modular design of IC units allows for quick redeployment should market prices or reliability requirements change. Under such circumstances, the owner can resell the units into a somewhat active secondary market if they are no longer needed. The smaller size of individual IC units allows for separate dispatch of small amounts of capacity, while remaining close to the most efficient generation set point of each of the individual units in a given installation.

**New Thermal Resource: SCCT Frame Engine**

Utilities install larger simple cycle combustion turbines (e.g. GE Frame 7EA or 7FA gas turbines) to meet peak load and local reliability obligations. These units can start and reach full generation on relatively short notice. They also require less capital investment (on a \$/kW basis) than IC units, aero-derivative SCCTs, or CCCT's. If short lead time is the driving criteria, modular units like LM6000s, diesels, or recips can be constructed in a shorter time than the frame engines. With a fairly high heat rate of over 10,000 Btu/kWh for the least expensive SCCT – the GE Frame 7EA- the wholesale market heat rate rarely reaches levels that justify running these units. As a result, these units may go months (or even years) without operating in anything other than test mode.

**New Thermal Resource: LM6000 Engine**

The General Electric LM6000 is a modular aeroderivative gas turbine generator originally adapted for marine use. Net capacity for the LM6000 is 42-47 MW. Utilities generally utilize LM6000s as peaking and fast response units. The smaller size and modular design of the LM6000 permits rapid construction and siting close to load centers. The LM6000 is reasonably efficient at around 9500 Btu/kWh heat rate, although this is not as low as CCCTs. The relatively low outlet temperatures of the LM6000 make it unlikely that configuring the LM in a combined cycle plant would make sense.

**New Thermal Resource: Aero-derivative**

Smaller aero-derivative units are available in the 10-25 MW range that share many of the attributes of the LM6000 described above. The smaller aero-derivative units can be tailored to a specific capacity need or to site parameters, but have a higher cost profile due to the loss of some economies of scale and have a slightly higher heat rate in the 10,000+ Btu/kWh range.

**New Thermal Resource: Combined Cycle Combustion Turbine (CCCT)**

The CCCT is a configuration where the waste heat from a gas turbine produces steam in a heat recovery steam generator (HRSG) that powers a second generator. Recovering the waste heat from the gas turbine greatly improves the overall efficiency of the plant when compared to

operation of the gas turbine generator alone. A typical CCCT configuration utilizes two gas turbines that exhaust into a single HRSG. CCCTs require much more time than SCCTs to bring the facility to full load due to the operational requirements of the steam cycle. Once loaded, CCCTs operate most efficiently at full design output, which makes it more difficult to cycle these plants without incurring significant costs. This operational consideration, coupled with their relatively low heat rate of just under 7,000 Btu/kWh makes it more efficient to run these units in a baseload manner rather than the peaking manner in which SCCTs operate.

### **New Thermal Resource: CCCT with Carbon Capture and Sequestration**

Carbon Capture and Sequestration (“CCS”) is an emerging technology seeking to capture the CO<sub>2</sub> emissions of power plants and sequester them by pumping them underground or otherwise entraining the gas in solids or other materials that do not allow the gas to readily transmit to the atmosphere. Currently there are some CCS test sites in development, but no commercially sized CCS processes in operation. The capture of the emitted CO<sub>2</sub> and sequestration process places a significant parasitic load on the generator – perhaps as much as one-third of the total energy produced. This will increase cost. One potential area for synergistic value would be to couple the sequestration process with sites for enhanced oil recovery. The enhanced oil recovery process already involves pumping gas or water into oil fields to increase the output and total oil recovery, so using the captured CO<sub>2</sub> would save money and provide a revenue stream for the power plant that could be used to offset the costs of the parasitic load. Application of CCS to a CCCT makes no sense economically, since the sequestration process would double the capital cost of the CCCT, while the parasitic load effectively increases the heat rate of the unit to the range of a Frame 7EA SCCT (10,400 Btu/kWh). Conventional coal generation emits approximately twice as much CO<sub>2</sub> per MWh produced than natural gas generation from a CCCT. The new technology is likely to be deployed first to these larger point sources before application to a lesser emitter like a gas unit.

### **New Thermal Resource: Combined Heat and Power (“CHP”)**

CHP involves co-location of a steam generating power plant with an industrial process that can use some of the heat output. Under such circumstances, the industrial customer purchases steam

output from the heat-recovery steam generator. The steam sale commitment by the project owner to the industrial customer reduces both the electrical output of the generation facility and impairs the flexibility of the plant for power operations. Since the industrial process usually requires a continuous supply of steam to support its manufacturing process, the inclusion of a spare boiler in the facility design allows for a continuous supply of steam should electric generation prove uneconomic due to prevailing wholesale energy market prices. The effective heat rate for a CHP plant, considering the benefits of the steam sales to the host facility, can be under 6,000 Btu/kWh for a large generation facility with a GE Frame 7FA gas turbine. However, CHP operation requires meeting the steam purchaser's process needs first, with dispatch flexibility a secondary objective. Furthermore, it is difficult to find industrial host processes where the value derived from supplying steam exceeds the value of the electric generation revenue lost. CHP opportunities will be extremely site specific, with a variety of factors that affect the cost and operating parameters of the facility. Without site specific information on the steam requirements of an industrial host's steam volume and reliability needs, NorthWestern has struggled to define the cost and operating parameters for a generic CHP facility.

### **New Thermal Resource: Coal Supercritical**

Pulverized coal plants comprise a very large part of the electrical production in the United States today, with unit sizes ranging from around one hundred to over seven hundred megawatts. The efficiency of coal plants can be increased significantly by operating the steam cycle in the supercritical region, which means that the temperature and pressure is elevated until the steam takes on properties combining those of gas and steam. This process increases the efficiency of the plant and reduces the carbon emission rate significantly when compared to older subcritical coal plants. Supercritical coal plants are the current standard for new coal plant construction. Despite the reduction in CO<sub>2</sub> emissions, the supercritical coal plant still emits approximately 0.9 tons of CO<sub>2</sub> per MWh produced. Due to this relatively high level of carbon emissions, the sponsor of a new supercritical coal plant would face difficulty obtaining the necessary air quality permits to operate the facility. Furthermore, potential federal legislation that exposes new coal

plants to costs based on carbon emissions taxes or exposure in a cap-and-trade scenario creates significant cost uncertainty for this type of facility.

### **New Thermal Resource: Integrated Gasification Combined Cycle (IGCC)**

IGCC plants are generating facilities that utilize a carbon based feedstock such as coal or petroleum coke (a by-product of oil refining) to produce power. IGCC projects use fuel that is first “gasified” and then used as the primary fuel in a CCCT plant. The gasification process has been successfully deployed on a commercial basis in the US<sup>1</sup>. However, the combination of gasification and CCCT technology strictly for power generation remains rare. Two IGCC plants currently operate in the United States – the 262 mw Wabash River Repowering IGCC in Indiana and the 250 mw Tampa Electric Polk Power Station in Florida. Recently, Energy Northwest attempted to permit the Pacific Mountain IGCC plant on the Columbia River near Kalama, Washington. The State of Washington rejected the Pacific Mountain IGCC permit applications because the project design lacked a carbon sequestration plan compliant with State law. While IGCC plants do tend to reduce the carbon emissions below that of a conventional coal plant, they still produce about 0.8 tons of CO<sub>2</sub> emissions per MWh produced.

### **New Thermal Resource: Coal Supercritical or IGCC with CCS**

As with the earlier explanation related to CCCT with CCS, the combination of CCS technology with a supercritical coal or IGCC plant would significantly lower the carbon emissions of the facility. However, the capital and operational costs of CCS, when added to the costs of either a supercritical coal or IGCC facility, would significantly increase the cost of either option. Furthermore, the exact cost of additional equipment and the effect on operating costs due to CCS remain highly uncertain due to the developing nature of CCS technology and the dependence on site specific parameters. Although NorthWestern developed economic parameters for generic IGCC and supercritical coal plants with CCS for plan analysis purposes, these assumptions could prove inaccurate when compared to the actual cost experience of developers of this type of facility.

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<sup>1</sup> The Coffeyville Resources nitrogen plant in Kansas, built in 2001, which gasifies petroleum coke to produce nitrogen fertilizer, provides an example of a gasification process not tied to power generation.

**Summary of Plant Parameters:**

Table 23

<b>Carbon Emissions</b>	
<b>Resource</b>	<b>CO<sub>2</sub> Emissions Tons / MWh</b>
Gas - Basin Creek	0.58
Gas - Mill Creek	0.59
Gas - IC	0.58
Gas - SCCT Frame	0.37
Gas - LM6000	0.58
Gas - SCCT Aero	0.58
Gas - CCCT	0.43
Gas - CCCT w/CCS	0.04
Gas - CHP	0.43
Coal - Colstrip 4	1.25
Coal - PV Super	0.91
Coal - PV Super w/CCS	0.12
Coal - IGCC	0.79
Coal - IGCC w/CCS	0.08
<b>Market / Contract Purchase</b>	<b>% Allocation To Coal</b>
Market / Contract	60%
<b>Note: QF coal + BGI = 700,000 MWh annual production.</b>	

Note: As displayed in the table above, market and contract purchases receive an allocation of 60% coal and 40% hydro or non-carbon emitting for purposes of calculating potential future carbon penalties. Recent climate legislation drafts have suggested that market and contract purchases that aren't associated with a specific resource be assigned a resource allocation mix consistent with a regional resource allocation mix. NorthWestern has assumed the state of Montana's general resource mix for this purpose. Several state and regional publications, including EPA data, report that coal plants comprise roughly 60% of Montana's generation mix,

with hydro plants and other types of generation making up the remaining 40%. Therefore, 60% of unspecified market and contract purchases receive Colstrip Unit 4’s carbon emissions factor of 1.25 tons/MWh and 40% is assumed to be non-carbon emitting.

Table 24

<b>Carbon Pricing</b>		
<b>Year</b>	<b>CO<sub>2</sub> Penalty \$/Ton CO<sub>2</sub></b>	<b>CO<sub>2</sub> Emissions Covered</b>
2010	0%	0%
2011	0%	0%
2012	0%	0%
2013	69%	0%
2014	68%	0%
2015	64%	0%
2016	67%	0%
2017	60%	69%
2018	59%	64%
2019	59%	60%
2020	59%	59%
2021	58%	58%
2022	58%	58%
2023	58%	58%
2024	58%	58%
2025	57%	57%
2026	57%	57%
2027	45%	45%
2028	34%	34%
2029	22%	22%

**New Renewable Resource: Wind**

Commercial wind generators are currently sized up to 1.5 MW, although the industry is currently in transition to larger units scaled at 2.5-3 MW per turbine. Wind generators are generally aggregated into farms of 25 MW or greater to capture economies of scale. Annual capacity factors for wind projects typically average between 25% to 40%, but Montana is fortunate to have a robust wind resource and an adequate number of sites have been identified that could generate at annual capacity factors in the upper 30% range and even in excess of 40%. Recent

NorthWestern Energy experience with the Judith Gap Project indicates that well sited wind projects can achieve this level of annual capacity factor.

Due to their intermittent nature, wind resources serve primarily as an energy resource rather than a capacity resource. They act primarily to displace other more expensive variable-cost forms of generation, such as natural gas generation. The Northwest Resource Adequacy Forum has determined, and included in their publication “A Resource Adequacy Standard For the Northwest”, that 15% of the installed nameplate generating capability of wind farms can be counted as capacity by utilities in the northwest.

NorthWestern Energy has recently initiated a wind review team that is working to determine how much wind NorthWestern Energy can integrate into its Balancing Area and the cost implications of this integration effort. The Wind Integration Group expects to have results late in 2010 that may inform future resource acquisition decisions.

### **New Renewable Resource: Woody Biomass**

Biomass, a renewable energy source, is biological material derived from living, or recently living organisms. Biomass energy is derived from three distinct energy sources: wood, waste, and alcohol fuels. Wood energy is derived both from direct use of harvested wood as a fuel and from wood waste streams. The largest source of energy from wood is pulping liquor or “black liquor,” a waste product from processes of the pulp, paper and paperboard industry. Waste energy is the second-largest source of biomass energy. The main contributors of waste energy are municipal solid waste (MSW), manufacturing waste, and landfill gas.

NorthWestern prefers to acquire dispatchable resources, that is, resources which can be turned on and off and ramped up or down in response to the utility’s load. Non-dispatchable resources, notably wind and solar applications, frequently produce power when it’s not needed or fail to generate electricity when it is. Dispatchability adds to the flexibility and value of the supply resource. Biomass plants are dispatchable.

The company needs to acquire additional renewable resources to comply with the State’s renewable portfolio standard (RPS) law. Biomass is a renewable resource in Montana.

The single most important risk factors for biomass generation are the security of the fuel supply and fuel supply price. It will be difficult to acquire a biomass plant for the portfolio without a substantial supply of fuel at favorable prices. It also would be helpful for a biomass plant to source fuel from several vendors to insure that if one vendor ceases operations or cannot otherwise meet its fuel supply obligations, the plant can continue operations.

The potential market for forest and mill residues is well diversified but prices can be highly variable, including times when potential sales of wood residues to parties other than a biomass plant may be more remunerative. Accordingly, while there are advantages to a wood residue producer supplying fuel to a biomass plant, there also are opportunities which may be foregone in the future.

Biomass energy to date is relatively high cost when compared with other renewable energy supply alternatives. Over the next 20-year period, biomass price ranges between \$88.00 and \$128.20 per megawatt hour (MWh) with a levelized price during that period of \$101.50/MWh. During that same time period, the Mid-Columbia forecast ranges between \$46.20 and \$81.51 per MWh with a levelized price of \$59.14 per MWh. Thus, biomass is estimated to be \$42.36 per MWh higher than market on a levelized basis over the next 20 years.

As described earlier, NorthWestern has focused its modeling effort on renewable resource options that represent a plausible group of known development options. These options include wind power and woody biomass projects; and to a lesser extent small hydro. NorthWestern is aware that these two renewable generation options are actively being evaluated and pursued in Montana by multiple parties. Additionally, NorthWestern is aware that small hydro developments in the form of qualifying facility inquiries and requests are present in the QF queue. With the issuance of an updated QF-1 tariff rate in Montana, NorthWestern anticipates that both small hydro, wind, and possibly other projects will seek and obtain contracts with NorthWestern.

## Resource Capacity Value

For NorthWestern, historic planning for the supply needs of the resource portfolio has meant planning for the energy needs of customers. Energy planning and purchasing, whether from on-system resources or the market, is distinctly different from capacity planning. For NorthWestern, supply planning has focused on making purchases (primarily) for the increment of need which is the difference between load and existing resources. The current Supply portfolio is a mixture of both energy and capacity resources. Resources such as Colstrip 4 and Basin Creek have capacity value in that they are capable of meeting demand by delivering power when it is needed. In the case of Colstrip 4, this resource is a baseload coal unit that typically supplies power over extended periods of time at known and predictable output levels. NorthWestern strongly believes that firm market purchases should be considered to have an implicit capacity value because for planning and practical purposes, they can be counted on to meet customer demand and have been employed for that purpose.

Basin Creek also supplies capacity, however, it is considered more of a peak demand resource because it is not used continuously as is the case with the baseload Colstrip unit. The physical dispatch capability of Basin Creek and the associated control of the plant means it is used to meet load based on changing needs. Basin Creek also supplies reserves. Supplying reserves requires that a specified increment of the plant be held in “reserve” unless called upon to supply capacity to the transmission system. In this regard, Basin Creek is providing a capacity-based product to the Supply portfolio.

Planning for energy requirements instead of capacity requirements has created some advantages for NorthWestern and its customers. Because of its efficient use of market purchases, exchanges and the availability of short-term purchase products, NorthWestern has not needed to acquire and maintain reserve margin or excess capacity to meet peak demand and provide reliability. Reserve margin (typically in the range of 12 – 15%) is the incremental capacity above expected needs that many utilities maintain for reliability and resource adequacy purposes. By using the market NorthWestern has not incurred the costs to purchase and maintain reserve margin.

Planning for energy acquisition rather than capacity needs has allowed NorthWestern to purchase up to its needed volumes and no more. This condition exists for NorthWestern because of excess generation on the Montana system and in the Northwest. For this planning period, NorthWestern expects to continue the practice of buying in the market to satisfy the last increment of resource need.

There are capacity implications and impacts for NorthWestern that are associated with different types of supply resources. The ability to efficiently and economically serve load is a key consideration when intermittent wind power is included in the Supply portfolio. Wind is primarily an energy resource that has a limited capacity value. Because wind power is only available when the wind blows, it cannot be relied upon to meet demand. For any electric generation resource there is a chance that it will not be available to meet demand. However, the intermittent nature of wind means the output from wind power is prone to change frequently and by large percentages of its installed capacity. The current volume of wind power in the NorthWestern supply portfolio (approximately 140MW) is significant; particularly because of the limited resource flexibility in the remainder of the portfolio.

Wind capacity value is a topic of ongoing debate and concern. This issue has become more pronounced as more wind power has been placed onto utility systems and as wind power represents larger percentages of resource portfolios. NorthWestern has been forced to obtain more regulation to maintain transmission system performance criteria. As more wind power is placed into NorthWestern's balancing authority, it is expected that more regulation will be necessary. For Energy Supply operations, more wind power may require measures to help manage a growing fleet of wind farms. For comparison, it would require a 500MW wind farm operating at an average capacity factor of 40% to produce approximately the same amount of annual energy as the 222MW of Colstrip 4. This same 500MW wind farm would have only a fraction of the capacity value of Colstrip 4 and would require approximately 90MW of regulation using an 18% of installed capacity multiplier. Prior to the installation of commercial wind farms in Montana, the NorthWestern transmission required a total of 60MW of regulation resource for its entire system.

## Qualifying Facility Queue

During the period of July 1, 2002, through June 30, 2007, NorthWestern had a Commission approved QF-1 Tariff for new QF contracts set at a rate of \$32.75/ MWh that also called for QF contract terminations on June 30, 2007. This termination date was set with the anticipated end of NorthWestern's default supply service obligation at the time the Tariff was originally approved.

QF developers expressed an interest in, but were hesitant to sign short term contracts with no price certainty beyond the June 30, 2007, Tariff time frame. NorthWestern proposed a replacement Tariff under a regulatory process that was extended over several years and combined a series of yearly Docket filings D2003.7.86, D2004.6.96, and D2005.6.103, which became known as the QF Tri-Docket.

After several motions and reconsideration filings, Final Order 6501g was issued on June 7, 2007, allowing up to a 20 year contract and price certainty for QF developers. The first contract negotiations following Order 6501g led to an impasse on wind integration charges and the QF community appeared to delay further negotiations pending the results of a 120 day petition on contract terms and integration charges which led to the impasse. Following Final Order 6886a dated April 23, 2008, in the 120 contract impasse Docket, it appeared that some developers were beginning to communicate a desire to renew negotiations.

NorthWestern first established a QF queue during this time frame as an orderly and fair way to process the backlog of some 40 or more potential QF requests that had been building during the Tri-Docket and subsequent QF related hearing processes. The QF Queue process was implemented and conveyed to all developers requesting contract information in a series of communications beginning May 7, 2008 and ending August 1, 2008. Many of the QF developers requesting a contract were provided a base copy for their review and signature. While these developers were provided contracts, they have yet to sign them. The contracts provided to the developers reflect the MPSC's QF-1 Orders that were in effect at that time.



viability of these individual projects. Out of these possible projects, 11 are wind proposals representing 97 MW or 80% of the name plate capacity. The remainder, consist of 13 hydro projects at 19 MW or 15% and 1 biomass project at 6 MW or 5% of the name plate capacity.

Table 26

<b>NorthWestern Active QF-1 Requests</b>			
<b>Count</b>	<b>Facility</b>	<b>kW</b>	<b>Generation</b>
1	F Creek	2,000	Hydro
2	A- Drop	1,250	Hydro
3	Greenfield	800	Hydro
4	Johnson	1,000	Hydro
5	Knights	1,100	Hydro
6	Woods	1,500	Hydro
7	Kenfield I	10,000	Wind
8	Kenfield II	10,000	Wind
9	Martinsdale I	10,000	Wind
10	Martinsdale II	10,000	Wind
11	Martinsdale III	10,000	Wind
12	Diamond T	10,000	Wind
13	Talrace	500	Hydro
14	Goldhahn	1,890	Wind
15	Timberline	50	Hydro
16	Muzzin	5,000	Hydro
17	Muzzin	5,000	Hydro
18	Sakis	10,000	Wind
19	Palagi	5,000	Wind
20	Talley	80	Hydro
21	Spencer	6000	Bio Mass
22	Potosi	250	Hydro
23	Momentum	10,000	Wind
24	O'Connor	10,000	Wind
25	Yellowstone	300	Hydro
Total kW of QF Requests		121,720	
<b>kW</b>	<b>Type of Generation</b>	<b>% Share</b>	<b>No.</b>
96,890	Wind	79.60%	11
18,830	Hydro	15.47%	13
6,000	Bio Mass	4.93%	1
0	Solar	0.00%	0
		100.00%	25

With indication from these owners that they intend to proceed with development of these individual projects, NorthWestern has modeled their contribution to the supply portfolio based on the historical energy and capacity from like type resources that have current QF contracts. Those facilities that have begun negotiation of contract language were forecast to begin delivery in the second quarter of 2011 with the remainder scheduled to begin delivery in 2012.

## Fuel Considerations

The new resources contemplated in the Plan are generic particularly because of global assumptions regarding potential plant siting and fuel delivery and supply considerations. For any new plant that is not located in close physical proximity to its fuel source, a number of factors must be considered before a final determination can be made about total cost of delivered fuel and ultimately the cost of the resource. It is therefore prudent to expect that any plants relying on natural gas will require detailed and definitive study of the NorthWestern gas transmission system to determine the timing and magnitude of infrastructure investment necessary to meet new plant fuel delivery requirements.

Capital costs, as presented in this plan, are generally assumed to include interconnection costs to both the NorthWestern electric and/or natural gas transmission systems. Except in the cases where coal-fueled facilities have been evaluated outside of Montana, capital costs have not included the costs of potential additional electric and natural gas transmission infrastructure. Until actual siting is considered, it would be difficult and misleading to suggest what these costs might be.

## On-System Resources

In considering future resource options for the Supply portfolio, NorthWestern has contemplated both on-system and off-system resources. On-system resources would be those located in Montana and that connect directly from the generator to the NorthWestern high-voltage transmission system. Off-system resources refer to resources that would be located outside of the footprint of NorthWestern's control area and not connect directly to NorthWestern's transmission system.

For the purpose of serving load, the physical delivery of energy from an on-system generator to the NorthWestern transmission system is the preferred mode of delivery. In this case, NorthWestern would not incur additional transmission charges if the generator was otherwise delivering its output to another high-voltage transmission system. For purpose of scheduling the delivery of generator output for use in the Supply portfolio to serve load, an on-system resource is the preferred alternative. However, NorthWestern does employ alternative and economically attractive purchase mechanisms. A physical exchange involves trading power that NorthWestern owns or is contractually committed to outside the NorthWestern transmission system for power on the NorthWestern transmission system. In doing so, NorthWestern avoids paying transmission costs to move energy from a remote location to the NorthWestern control area where it can be used to serve retail load. Entities that have generation located in Montana but serve load in a different control area are prime candidates to enter into exchanges, as they can avoid costs associated with moving their power from Montana to their load. Exchanges provide a cost effective method of procuring energy and avoid the expense and energy losses associated with moving energy across multiple transmission systems.

The 2009 Plan considers resources that might otherwise not be sited in Montana and connected directly to the NorthWestern transmission system. The resource types referenced here include new coal-fueled resources including supercritical coal and integrated gas combined cycle plants, with and without carbon capture and sequestration technology. These resource options were sited out of state because of siting concerns for coal resources in Montana. Siting outside of Montana may require new transmission infrastructure for energy deliver to the NorthWestern transmission that would increase the delivered cost of power. In recognition of these costs of delivery, NorthWestern has included in its analysis of potential off-system resources, estimated added costs for transmission.