APPENDIX 2

GLOSSARY

A

Acre-foot	A unit of volume used for reservoirs (1 acre-foot = 43,560 cubic feet).
Albedo	The ratio of reflected radiation from a surface to the incidental radiation upon it.
Area Control Error	The difference between scheduled and actual generation; positive values indicate over-generation.
Attainment	A (NAAQS) air quality status for an area with concentrations of criteria pollutants that are below levels established by NAAQS.
Average Annual Energy	The total amount of energy, measured in kWh or MWh, delivered over a period of one year divided by 8,760 hours per year.
Avoided Costs	Incremental cost for energy generated or acquired from another source.

B

Backward pass	Dynamic programming for automatic resource selection determines the optimal expansion path. The optimization routine does this through a two-pass process. The first pass is a backward pass that determines the number of feasible resource additions that satisfy the reserve margin constraints.
Balancing Authority	The responsible entity that maintains load-interchange-generation balance within a Balancing Authority Area, and supports Interconnection frequency in real time.

Balancing Authority Area	The collection of generation, transmission, distribution infrastructure, and load-resource balance within the metered boundaries of the Balancing Authority.
Baseload	The minimum amount of electric power delivered or required over a given period at a constant rate.
Bottom Ash	The waste mineral content found at the bottom of a boiler after complete combustion from burning pulverized coal.

C

Capacity	(Nameplate capacity) The maximum power output potential a machine or system can produce or carry under specified conditions generally expressed in kW or MW; (current capacity) instantaneous measurement of power delivery; (capacity resource) expression of capability to serve load.
Capacity Factor	The ratio of actual output to potential output over a period of time. Normally calculated by actual output in MWh divided by the product of nameplate capacity times 8,760 hours.
CapEx	Capital expenditure reflecting the cost of a resource, a project, or the expense to repair an asset.
Capital Structure	The mix of a company's long-term debt, specific short-term debt, common equity and preferred equity, which determines how a corporation finances assets.
Choice Customer	(NorthWestern) A NorthWestern electric service customer with an average monthly demand greater than or equal to 5,000 kW who chooses to buy power from a third party but uses NorthWestern transmission distribution, and other ancillary services (defined in § 69-8-201, MCA).

Community Renewable Energy Project	A Montana eligible renewable resource that is either owned by a public utility, or by specifically defined local owners that have a controlling interest, and is less than or equal to 25 MW in nameplate capacity, (defined in § 69-3-2003(4), MCA).
Confidence Interval	A range, calculated from a sample that likely contains the true value of a parameter, and is expressed with a confidence level. For example, there is 90% confidence that the interval from P5 to P95 will contain the mean if sampling is repeated.
Contingency Reserves	The provision of capacity deployed by the BA to meet the Disturbance Control Standard and other NERC and Regional Reliability Organization contingency requirements.
Cooling Degree Day	A measurement used to indicate a building's cooling (air conditioning) energy consumption, defined relative to an outside (base) temperature, below which the building needs no cooling.
Cost of Equity	The rate of return paid by a company to its equity investors.
CPS1	(NERC Control Performance Standard 1) A regulating standard for calculating the frequency error for a balancing authority.
CPS2	(NERC Control Performance Standard 2) A regulating standard for balancing authorities intended to minimize excessive power flows due to corrections to CPS1 scores.
Criteria Pollutants	EPA identified pollutants under the 1970 Clean Air Act amendments setting standards for total suspended particulates, sulfur dioxide, nitrogen oxide, ozone, carbon monoxide, and lead.
Cross-flow	Hydroelectric turbine design.

Customer-generator	A user of a net metering system.

D

Deterministic	Process or model in which the output is fully determined by inputs, thus containing no variability or risk.
Development	(Specifically as used in reference to Hydros projects) Refers to replacing units or adding new equipment, as defined by IEEE STD 1147-1991.
Diffuse Horizontal Insolation	The amount of insolation received by a surface that does not arrive directly from the sun but has been scattered by atmospheric particles and comes from all directions.
Dispatchability	The ability of a generating resource to deliver its output on demand.
Dynamic Programming	A method for solving a complex problem by breaking it down into smaller sub-problems, solving the sub-problems once and storing the solutions so that they can be looked up without resolving.

E

Economic Derate	A reduction in generation due to availability of cheaper energy.
Energy Use Index	The measure of a building's energy use as a function of size, typically expressed in units of (Btu/square feet).

F

Fish ladder	A structure to facilitate fish migration over or around obstructions such as dams.
Flexible Resource	A generating plant that has the capability to handle fast start-up and ramping allowing it to handle multiple daily on and off cycles.

Fly Ash	Non-combustible residual particles from the combustion process carried by flue gas.
Francis	Hydroelectric turbine design.
Fundamental Market Relationships	The market price for electricity is governed by supply and demand economics, and is partially dependent on the market price of natural gas, through the spark spread and, more directly, the heat rate of natural gas-fired generation.

G

Gap analysis	A strategic planning process of determining and documenting the difference between business requirements, or desired performance, and current capabilities.
Geothermal Energy	Heat energy generated and stored in the Earth, which can potentially be converted to create steam to generate electricity.
Global Horizontal Insolation	The amount of insolation received by a surface parallel to the ground.
Grid.Balancer	Energy storage system from Demand Energy used with Joule.System.
Grid.DNA™	Graphical user interface from Demand Energy used by Joule.System.
Ground Cover Ratio	The ratio between the surface area of a collection of solar PV panels and the area on the ground occupied by the solar PV system.

H

Head	(Hydraulic head across a dam) A measure of water pressure based on height differences in water upstream and downstream of a dam.
Heating Degree Day	A measurement used to indicate a building's heating energy consumption, defined relative to an outside (base) temperature, above which the building needs no heating.
Heat Rate	The amount of thermal energy (Btus) required by a generating unit to produce 1 kWh of electrical energy, expressed in this Plan as the higher heating value heat rate.
Heavy Load Hours	(On-Peak Hours) The periods of the week designated as traditionally having higher energy use; defined as hour ending 7 through hour ending 22 (inclusive) from Monday – Saturday.
Henry Hub	Natural gas distribution pipeline hub in Louisiana referenced as the principle pricing reference point in North America.
Higher Heating Value	(Heat Rate) A specific measure of the heat of combustion, the total energy released as heat, which is determined by bringing all products of combustion back to pre-combustion temperature and condensing any vapor produced.
Hydraulic Capacity	(Hydroelectric dam reference) A measure of the potential power generation for a hydroelectric dam based on current head and flow conditions.
Hydros	The system comprised of 11 hydroelectric dams and 1 storage dam purchased by NorthWestern in 2014 from PPL Montana.

I

Integrated Gasification Combined Cycle	A technology that converts coal into a pressurized synthetic gas (syngas) which facilitates the removal of impurities before combustion for power generation.
Intercontinental Exchange	A trading platform that helps to define markets through an electronic exchange including energy commodities and other products.
Illiquid	(Market) Condition where commodities are not easily sold or exchanged for cash without significant loss in value or due to a lack of buyers and sellers.
Implied Volatility	A measure of future potential market price moves; high IV indicates large price swings (either positive or negative) while low IV indicates smaller price swings.
Insolation	The amount of solar radiation energy that reaches the earth's surface over a specified period of time, typically measured in units of (kWh/m^2).
Integration	(Resource use) The process of adding new generation resources and rebalancing the operations of existing resources in a portfolio to continue to meet load and other balancing authority requirements, including regulation reserves, imbalance service, and scheduling.
Interconnected	(Transmission Grid use) The condition of being electrically connected and in synchronous operation with the electric transmission system operated by a BA.
Intermittent	(Resource use) Not continuously available, random, or varying in output.
Inverter	An electronic device that converts direct current (DC) to alternating current (AC), i.e., solar PV generation to grid-compatible power.

J

Joule.System	Integrated energy storage and management system designed by Demand Energy.

K

Kaplan	Hydroelectric turbine design.

L

Light Induced Degradation	The initial process of declining efficiency in solar PV cells after first exposure to sunlight. It results in a permanent reduction in nameplate capacity.
Light Load Hours	(Off-Peak Hours) The periods of the week designated as traditionally having lower system demand; hours not included in the definition of Heavy Load Hours.
Liquid	(Market) Condition where many buyers and sellers exist and commodities can be easily exchanged for cash without significant loss in value.
Load Following	The use of on-line generation, storage, or load equipment to track the intra- and inter-hour changes in customer loads, similar to regulation, but over longer periods of time.
Load Shifting	Moving the time period of a portion of electricity demand from higher demand hours to lower demand hours.
Loss of Load Expectation	(as defined by NERC) The expected number of days per year for which available generating capacity is insufficient to serve the daily peak demand (load). The LOLE is usually measured in days/year or hours/year. The convention is that when given in days/year, it represents a comparison between daily peak values and available generation. When given in hours/year, it represents a comparison of hourly load to available

	generation. LOLE is sometimes referred to as loss of load probability (LOLP). Also see LOLP.
Loss of Load Probability	(as defined by NERC) The proportion (probability) of days per year, hours per year, or events per season that available generating capacity/energy is insufficient to serve the daily peak or hourly demand. This analysis is generally performed for several years into the future and the typical standard metric is the loss of load probability of one day in ten years or 0.1 day/year. Also see LOLE. The NWPCC uses a metric, which establishes a minimum threshold LOLP standard of 5% for the Columbia River Basin (Region).

M

Market Taker	An entity that must accept whatever price the market dictates.
Mass-based	EPA CPP methodology for reducing CO_2 emissions by using goals specifying the total weight of CO_2 emissions measured in tons of CO_2.
Mean	(Statistical) Average or expected value of a set of values.
Meaningful Uncertainty	A stochastic modeling term that recognizes the need to produce plausible ranges of results that inform rather than providing results which effectively have no useful application.
Mean Reversion	The assumption that prices will eventually move towards the average price over time.
Microgrid	A localized electrical grid that can be disconnected from the traditional grid.
Minimum Down Time	(Generator use) A constraint on the least amount of time that a generating unit must be off after shutdown, typically due to necessary maintenance.

Minimum Up Time	(Generator use) A constraint on the least amount of time that a generating unit must be on once it starts, typically to minimize thermal stresses in the equipment.
Mode	(Statistical) The most often occurring value in a set of values.
Model Trading Rule	EPA CPP-proposed trading plan for carbon credits.
Monte Carlo	Modeling method that uses probability distributions for input values that have uncertainty, and produces distributions of possible outcomes.
Mountain Prevailing Time	Time of day based on the Mountain Time Zone and either Standard or Daylight Saving Time, whichever is applicable.
Must-take	(Resource use) A plant that requires, by physical design or contractual agreement, that the owner or purchasing customer accept all power production as it is generated.

N

Nameplate Capacity	The maximum rated generating output of a facility under specific conditions defined by the manufacturer.
Net Metering	Measuring the difference between the electricity distributed to and the electricity generated by a customer-generator that is fed back to the distribution system during the applicable billing period.
Net Present Value	The present value of future cash flows at a determined rate of return, used to discount future values back to today's dollars for a cost comparison of multiple projects, for example, alternative energy supply portfolios.
New Source Review	A CAA permitting program that requires industrial facilities to install modern pollution control equipment

	when they are built or when making a change that increases emissions significantly (as defined by EPA).
NGX	(TMX Group Limited – NGX) A Canadian natural gas exchange, trading, and clearing market.
Nodal Prices	Prices for a commodity such as electricity and natural gas determined by location or supply (interconnect) points and conditions of supply and demand associated with that location.
Non-attainment	(NAAQS use) Air quality status for an area with concentrations of criteria pollutants that are above levels established by NAAQS.
Non-Spinning Reserves	Off-line generation that is capable of being fully deployed within ten minutes and maintaining specified levels for at least sixty minutes.

O

Off-Peak Hours	Those hours defined by NAESB business practices, contracts, agreements, or guides as periods of lower electric demand and also may be those hours not included in On-Peak Hours (as defined in the QF-1 Tariff).
On-Peak Hours	Those hours defined by NAESB business practices, contracts, agreements, or guides as periods of higher electric demand and also may be the Heavy Load hours for the months of January, February, July, August, and December (as defined in the QF-1 Tariff).
1 in 2 (One in two) Peak Demand Forecast	A forecast based on a 50% probability that the forecasted value will be less than the actual peak demand, and a 50% probability that the forecasted value will be greater than the actual peak demand.

Optimization	Process of determining the lowest NPV utilization of resources to reliably meet energy, capacity, and ancillary needs.

P

P5	The 5th percentile of a sample is the value below which 5% of all values within that sample occur.
P95	The 95th percentile of a sample is the value below which 95% of all values within that sample occur.
Pacific Prevailing Time	Time based on the Pacific Time Zone and either Standard or Daylight Saving Time, whichever is applicable.
Parasitic Load	The power consumed by a generating device or system for its own operation and/or when not generating, such as transformer losses in a solar PV system at night.
Particulate Matter	Microscopic solid or liquid particles suspended in the Earth's atmosphere.
Peak Demand	Historical high point of collective power consumption.
Peak Shaving	Process of reducing the amount of energy purchased from a utility company during peak demand hours.
Pelton	Hydroelectric turbine design.
Performance Ratio	(Solar PV system) Ratio between actual annual production of AC energy and the theoretical annual production of energy.
Pet Coke	(Petroleum coke) A solid by-product of oil refineries that can be used as a fuel.
Petition for Certiorari	A written application to the United States Supreme Court (USSCt) to consider a case, which is used by the

	USSCt as a discretionary device to choose the cases that it will hear.
Photovoltaic	An electricity generation system that converts sunlight (photons) into electric current (voltage) within a semiconductor panel.
Plane of Array Insolation	The amount of insolation received by a surface parallel to solar panels.
PM_{10}	Particulate matter smaller than 10 microns in diameter.
Power Purchase Agreement	A contract between the utility and generation facility owner that defines the terms of the purchase and sale of energy production.
Prevention of Significant Deterioration	(as defined by EPA) A CAA New Source Review permitting program that applies to new major sources or major modifications at existing sources for pollutants where the area in which the source is located is in attainment or unclassifiable with the NAAQS. It requires the following: 1. installation of the "Best Available Control Technology" (BACT); 2. an air quality analysis; 3. an additional impacts analysis; and 4. public involvement.
Price-Taker	Company or resource that is not significant enough to influence the price of a good or service.
Procurement	The process of acquiring new resources.
Pro Forma	(Accounting use) A statement of a company's financial activities excluding unusual or non-recurring transactions.
Propeller	Hydroelectric turbine design.

PVsyst	Photovoltaic generation modeling software designed by PVsyst SA.

Q

Qualifying Facility	A small-scale renewable power producer that meets the capacity, fuel source, and operational criteria set forth by PURPA, including all pertinent requirements of Code of Federal Regulations Title 18 Conservation of Power and Water Resources and state law corollaries.
QF-1 Tariff	A MPSC approved electric tariff schedule that specifies rates and conditions for contracted renewable generation (Qualifying Facilities or QFs) power purchase terms between the utility (NorthWestern Energy) and the QF owner.

R

Ramp Rate	Speed at which a generator can increase or decrease generation, typically measured in units of MW/minute during the ramp period.
Rate-based	(CO_2 Emissions use) EPA CPP methodology for reducing CO_2 emissions that uses goals specifying the ratio of pounds of CO_2 emissions to the net energy produced, measured in units of (lbs. CO_2/net MWh).
Rate-based	(Resource use) A utility-owned generation resource in which the costs to purchase or build the resource are paid by the utility's customers through billed electric rates.
Rate of Return	The profit on an investment over a period of time, expressed as a proportion of the original investment.
Re-conductor	Replacement of a transmission line within existing infrastructure.

Regression model	A technique to analyze a dependent variable's reaction to changes in other independent (explanatory) variables.
Regulation	An ancillary service consisting of maintaining interconnection frequency, managing differences between actual and scheduled power flows, and matching generation to load, tracking minute-to-minute fluctuations in the BA as specified by NERC.
Rehabilitation	(Hydro Project use) Remanufacturing or refurbishing existing units, as defined by IEEE STD 1147-1991.
Reliability-Based Control	Refers to NERC Standard BAL-001-2, Real Power Balancing Control Performance. Among other things, the Standard requires a Balancing Authority to operate such that its Area Control Error does not exceed defined limits for more than 30 consecutive clock minutes. The Standard becomes effective July 1, 2016.
Renewable	A type of energy, or resource that generates the energy, that is produced from essentially sustainable fuel, such as falling water, wind, geothermal, or solar radiation.
Renewable Energy Credit	One megawatt-hour of renewable energy generation from an eligible renewable resource (defined by § 69-3-2003, MCA).
Replacement	(Contingency Reserves) Same as Non-Spinning reserves except with a 30-60 minute response time, and used to restore other contingency reserves to their pre-contingency status.
Reserve margin	Excess generating capacity above expected peak demand normally used in recovering from contingencies within the BA.
Risk premium	A monetary value associated with the risk of a specific portfolio, defined as the integral of the cost distribution above the mean.

Run-of-the-river	A FERC designation for a hydroelectric dam that must maintain minimum differences in upstream and downstream flow rates, and minimum storage reservoir level fluctuations, so that only water from upstream is available for generation at that moment and any unused amount must be spilled.

S

Scrubbers	Systems that remove particles or gases from industrial exhaust streams.
Solar PV	(see Photovoltaic) An electricity generating resource that uses sunlight as fuel to create an electric charge in semiconductor panels.
Spark Spread	The gross-generation profit margin earned by buying natural gas and burning it to produce electricity (compared to purchasing electricity from the market), which depends on energy prices and generator efficiency (heat rate), measured in units of ($/MWh).
Specific Yield	A standardized measure of energy output for a solar PV system in reference to the rated (peak) power output, in units of (MWh/MWp).
Spinning Reserves	On-line generation that is synchronized and ready to serve additional demand within ten minutes and can sustain that change in output for a minimum of sixty minutes, and can meet other WECC requirements.
Stochastic	A process in which there is inherent randomness; where the same inputs will produce a distribution of outcomes through iterative sampling of variables.
Sub-bituminous	An intermediate coal with properties between lignite and bituminous coal.

SunShot Initiative	A DOE program to make solar energy cost-competitive with other forms of electricity by the end of the decade, announced in 2011.
Supervisory Control and Data Acquisition	A computer-based system for remotely monitoring and controlling processes, such as power generation, electric transmission, and distribution.

T

Tier II	QF power purchase agreements that stemmed from MPSC Docket Nos. D97.7.90 and D2001.1.5, Order Nos. 5986w and 6353c.
Time of Use	A variable rate structure that charges customers a rate dependent on the time of day and season the energy is used.
Tolling PPA	A power purchase agreement where the buyer provides fuel as needed to meet the generation which is controlled and purchased by the buyer.
Tracker Period	(Tracker Year) A fiscal year from July 1 through June 30 of the following calendar year, used by NorthWestern's Electric Supply Cost Tracker.
Triangular Distribution	A probability distribution typically used when sample data and knowledge is limited. This distribution is defined by a lower limit, upper limit, and mode.
Turbine	A rotary mechanical device that extracts energy from a fluid (i.e. water) or the wind and converts it into work, such as turning a rotor.
Turgo	Hydroelectric turbine design.

U

Utility System	The interconnected grid within the BA area consisting of generation, transmission, and distribution equipment.

V

Volatility	The degree of variation of a market price over a period of time.

W

Waste Coal	A usable material byproduct of a previous coal processing operation.
Waste Coke	(See Pet Coke).
Weighted Average Cost of Capital	The rate that a company is expected to pay on average to all its security holders to finance assets. It is used to discount all costs back to present value in order to compare portfolio cash flows in the future. At the time of this Plan, NorthWestern used a WACC of 7.03%.

Z

Zero discharge	Permit requirement prohibiting waste water discharge from a site.