BASELOAD RENEWABLE ENERGY SUMMIT 3X
Geothermal·Hydropower·Biomass

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RENO, NV
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Baseload Renewables: The Important Facts

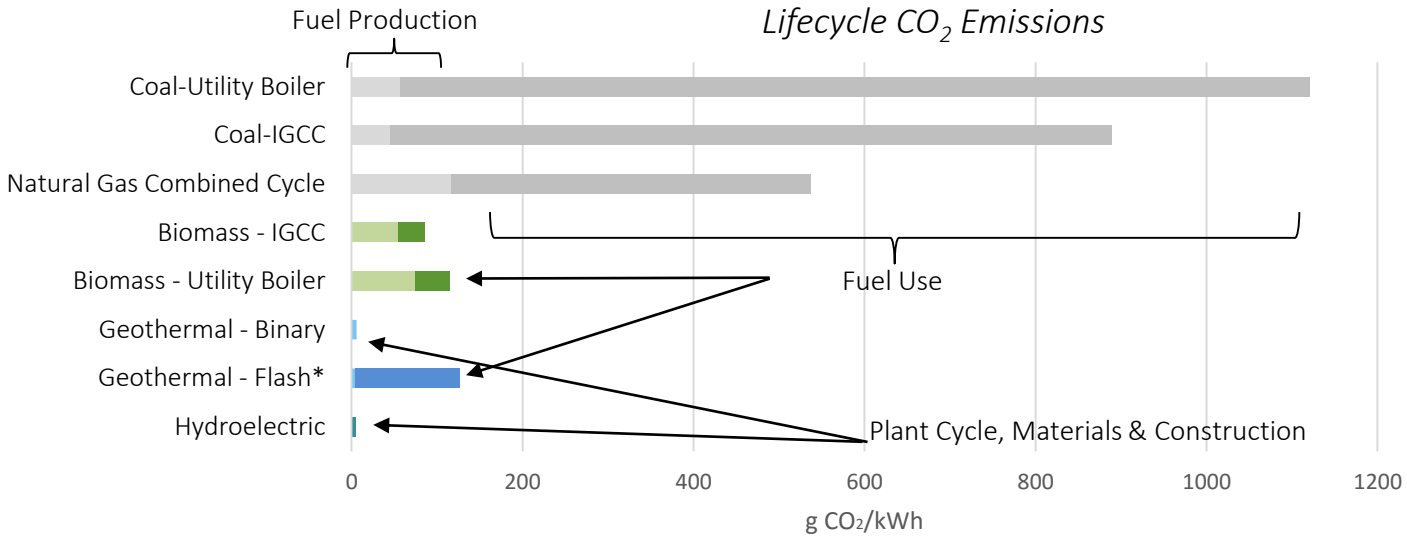
Renewable Baseload Technology Values	*Hydroelectric*	*Biomass*	*Geothermal*
Baseload Power	✓*	✓	✓
Flexible Power	✓	✓*	✓*
Load Following	✓	✓*	✓*
Spinning Reserve	✓	✓*	✓*
Replacement Reserve	✓	✓*	✓*
Inertia and Frequency Response	✓	✓	✓

* yes depending on the resource, technology type, or project economics

Baseload renewables are often forgotten in discussions on low-cost, clean energy development. They are an important balance to intermittent renewable energy sources and replacement for retiring coal generation. Baseload renewables can help load serving entities avoid incurring additional costs from purchasing and then balancing renewable intermittent power sources with storage or new transmission.

Hydroelectric, geothermal and biomass power provide numerous values to the grid that intermittent power sources cannot such as baseload power, regulation, load following or energy imbalance, spinning reserve, non-spinning reserve, and replacement or supplemental reserve.

Baseload renewables represent significant carbon dioxide savings when compared to the fossil fuel alternatives. After analyzing all parts of a power plant's life including, fuel use, fuel production, power plant materials and construction, baseload renewables represent an order of magnitude reductions in emissions compared to fossil fuel alternatives.



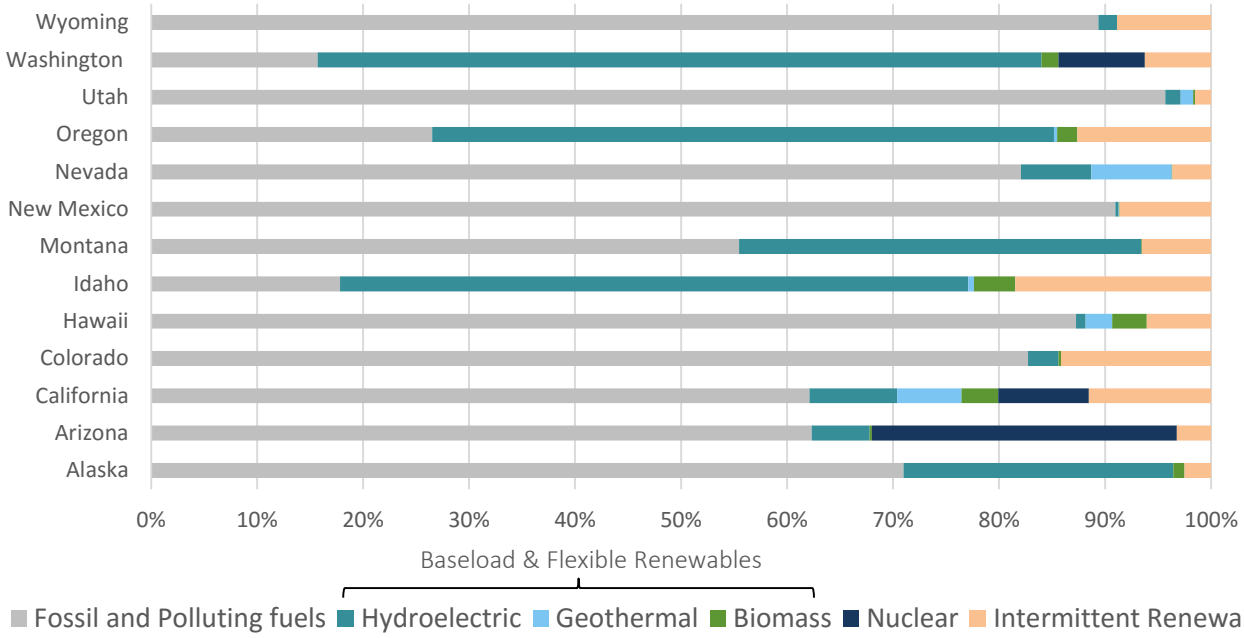
Studies show that a grid with more baseload renewables is in aggregate cheaper and has lower emissions than one that plans to integrate a large amount of intermittent resources. Future grids will require a mix of all the baseload renewable resources like hydropower, geothermal, and biomass to supplement intermittent clean generation. Baseload renewables can help keep grid costs low by eliminate curtailment or over generation at peak times.

Appropriate levels of baseload renewables on the grid eliminates scenarios with higher greenhouse gas emissions because of the use of dirty, peaking plants as backup generation. Peaking plants are used to fill in the peaks and valleys in the load curve caused by high penetration of intermittent power sources.

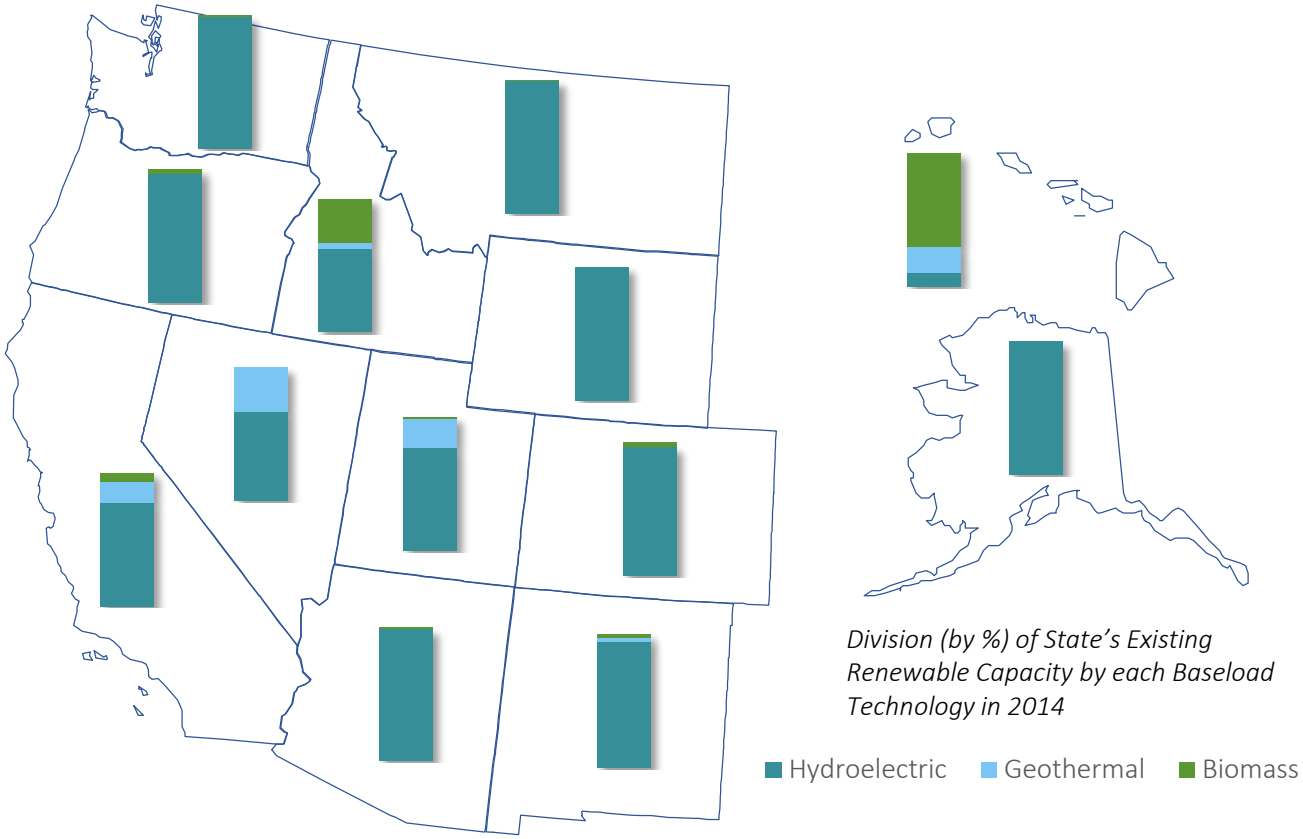
*Note: geothermal flash plants may emit small amounts of CO_2 with brine production. The value shown is an average/typical value. Actual values depend on resource geology and technology.

June 2016

Generation by Western State in 2014



Many western states still generate a significant amount of their electricity from fossil fuels and other dirty sources. These dirty resources are used for firm and flexible power to back up intermittent power sources. As electrical grids transition to cleaner energy across the country geothermal, hydroelectric and biomass power can be used as a clean alternative to fossil fuels by replacing them megawatt for megawatt. As load serving entities increase their penetration of low carbon alternatives, geothermal, biomass and hydroelectric power can help balance grids so that more intermittent power sources can generate electricity cleanly. Furthermore, instead of load serving entities engineering the grid to work for intermittent renewable sources or curtailing clean energy, building more baseload clean energy can allow for more renewables to come on to the grid. Studies show resource diversity is key to keeping electricity affordable and clean in a predominantly clean grid.



Division (by %) of State's Existing Renewable Capacity by each Baseload Technology in 2014

Sources:
Sullivan, J. L., and M. Q. Wang. "Life Cycle Greenhouse Gas Emissions from Geothermal Electricity Production." *Journal of Renewable and Sustainable Energy* 5.6 (2013): 63122. *scitation.aip.org.proxy1.library.jhu.edu*. Web.
Energy Information Administration. "U.S. States: State Profiles and Energy Estimates." U.S. Energy Information Administration, Sept. 2015. Web. 26 Apr. 2016..