**Comments of the Natural Resources Defense Council (NRDC) for the**
**US DOE Quadrennial Energy Review**
**Transmission, Storage, and Distribution of Electricity Public Hearing**
**Lewis & Clark College, Portland, Oregon**
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Submitted by: Carl Zichella, Director of Western Transmission
Natural Resources Defense Council

## I. Introduction and Summary:

The United States electricity system is undergoing more change than it has in many decades. The causes are numerous: a changing mix of resources – including a large and rapid increase of remotely located variable renewable generation – driven by lowering prices, climate change and policy considerations; the changing role of utility customers on the distribution grid from simple consumers to both consumers and generators of power; the rise of unconventional gas resources that is putting pressure on baseload conventional power sources like coal and nuclear energy; concerns over reliability and cyber-attacks; and the need to contain costs as future needs are identified and met in a timely way, to name some of the most important.

This rapid change is also being fed by rapid innovation and deployment of advanced power electronics, controllable and dispatchable energy efficiency and demand response programs, markets, and policies; as well as information technology and electricity storage that is increasing the speed of system scheduling and dispatch. Costly and destructive extreme weather events such as Superstorm Sandy have underscored the urgency to bolster the system and improve resiliency, the ability to quickly restore service after storm-related or other outages occur. A premium is being placed on consolidating and better coordinating control areas and enhancing situational awareness, both to enhance reliability and address perceived system vulnerabilities. The same changes that make the system more flexible and easily operated make integrating growing amounts of variable renewable energy resources easier and less expensive. Speed, efficiency, and enhanced coordination and control are some of the most important characteristics defining the 21st century grid. Flexibility, resiliency and security are the system's most critical needs.

## II. Specific Comments and Recommendations

**<u>Efficient use of the existing System: build what we need, not what we don't need</u>**

In determining what we need to do in terms of modernizing the grid for the 21st Century several key questions need to be answered:

1. How does the investment reduce Greenhouse gas emissions?
2. What does the 21st Century consumer want?
3. How can modernization and expansion occur at least cost and be best justified?

Let's look at these questions in turn.

1. <u>How does the investment reduce Greenhouse gas emissions?</u>

Greenhouse gas reduction is one of the most powerful drivers guiding public and private investment in the nation's transmission infrastructure, and for good reason. According to the National Climate Assessment and the Intergovernmental Panel on Climate Change, the effects of global warming are already being felt in the United States and across the entire planet[1][2]. Globally, the 12 hottest years on record have occurred since 1998. According to NASA's Goddard Institute for Space Studies, nine of the 10 warmest years ever recorded have occurred since 2000.The vulnerability of our economy to climate impacts such as rising sea levels, wildfire and drought and abnormally destructive weather events are major concerns driving public policy decisions across the nation at all levels of government. All are relevant in the Western Interconnection.

The challenge of preserving the health and safety of our communities and environment in the face of these impacts is already guiding resource choices as detailed in President Obama's Climate Action Plan, state renewable power procurement and climate goals and EPA's carbon rule[3]. According to the Environmental Protection Agency[4], average temperatures have risen in most states since 1901. Climate and weather disasters in 2012 cost the American economy more than $100 billion. The ranges of plant and animal species and habitats and the migratory behavior of many wildlife species are changing measurably. Impacts once just forecast are now occurring and the scientific consensus that urgent action is needed to limit the harm is overwhelming.

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[1] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: *Climate Change Impacts in the United States: The Third National Climate Assessment*. U.S. Global Change Research Program, 841 pp. doi: 10.7930/J0Z31WJ2.

[2] IPCC, 2014: Summary for Policymakers. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1-32.

[3] Environmental Protection Agency, 06/18/2014, Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, proposed rule, U.S. Federal Register, https://www.federalregister.gov/articles/2014/06/18/2014-13726/carbon-pollution-emission-guidelines-for-existing-stationary-sources-electric-utility-generating n

[4] EPA FACT SHEET: Clean Power Plan, Overview of the Clean Power Plan Cutting Carbon Pollution From Power Plants, June 2014.

Electricity generation resource choices in this regulatory environment will profoundly affect the design and operation on the 21st century grid. These choices will also have a influence how we plan and operate the system to best take advantage of the more variable yet potentially synergistic operating characteristics or renewable energy generation.

2. What does the 21st Century consumer want?

Some of the most obvious consumer desires are the same as they have always been: reliability, reasonable cost, and a system that can meet present and reasonably forecast future needs.

The reliability of the electrical system is arguably the single most important factor in maintaining a healthy economy. As the grid of the 21st century will be built to serve cleaner, more variable renewable energy, reliability will demand better operational coordination, situational awareness, communications, and more effective automated information and controls. These improvements, (and other operational changes identified in several different reports) which enable system operators to more efficiently dispatch resources and better utilize transmission assets, are serendipitously both beneficial to the least cost integration of renewable energy resources and system overall reliability.[5][6][7][8] The more flexible, coordinated and efficient the grid is the cleaner, more reliable and less costly it is for the environment and consumers.

Consumers are increasingly interested in having more choice about how their energy is provided and more control over their resources. This is perhaps best exemplified by the rapidly growing move into distributed energy – primarily solar – by many consumers. No longer do many households just buy power from utility companies, they make it themselves, and the distribution grid that was once a dropping off point for electricity from power companies, is the focus of a transactional relationship between electricity customers and the utility companies. This shift, along with reduced electricity consumption and increasingly effective demand response programs is forcing a major reconsideration of utility business models across the U.S.[9] as well as a revolutionary wave of innovation in technology (including electricity storage), regulation, and grid operations as the once clear line between the distribution and transfer of bulk electricity becomes increasingly blurred. As a result, the control architecture of the electricity system, on both sides of the meter, is and must continue to see major improvement. This is a role especially suited to the Department of Energy in its research and development programs.

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[5] Schwartz, Lisa, Porter, Kevin, Mudd, Christina, Fink, Sari, Rogers, Jennifer, Bird, Lori, Hogan, Mike, Lamont, Dave and Kirby, Brendan (June 2012). "Meeting Renewable Energy Targets in the West at Least Cost: The Integration Challenge," WGA, http://www.westgov.org/initiatives/rtep

[6] National Renewable Energy Laboratory (2012), "Renewable Electricity Futures Study." Hand, M.M.; Baldwin, S.; DeMeo, E.; Reilly, J.M.; Mai, T.; Arent, D.; Porro, G.; Meshek M.; Sandor, D. eds. 4 vols. NREL/TP-6A20-52409. Golden, CO: National Renewable Energy Laboratory. http://www.nrel.gove/analysis/re_futures/

[7] See also: Western Electricity Coordinating Council, September 8 Event Recommendations, June 30, 2014,Monthly Progress Dashboardhttp://www.wecc.biz/About/sept8/Documents/Progress%20Dashboard%20June%202014.pdf

[8] Carl Linvill, Janine Migden-Ostrander, Mike Hogan, "Clean Energy Keeps the Lights On," Regulatory Assistance Project, June 2014

[9] "Utility and Regulatory Models for the Modern Era", America's Power Plan, Ronald Lehr former Public Utilities Commissioner, The Electricity Journal, Volume 26, Issue 8, October 2013, Pages 35–53

Finally, polling has consistently shown consumer preferences for clean energy resources and energy conservation over polluting, high carbon ones, further driving resource choices that will require a more flexible, resilient, coordinated and efficiently operated transmission system at both the bulk and distributed levels.[10]

3. How can modernization and expansion occur at least cost (and be best justified)?

Despite distribution system changes that are driving innovation in business models, regulation and technology, investment in the bulk electricity grid will continue to be needed. This is because much of the best of America's vast renewable energy resources are located far from load centers and need hundreds of miles of new or repurposed transmission to reach the people who need it. Converting the world's largest economy from a high carbon emitting to a low-carbon system will require decades of work and a large amount of renewable energy resources. The progress being made on the conservation and distribution system will not be sufficient by themselves. Justifying the need for this transmission to regulators and the public is not an easy task, but it can be done, as the Bonneville Power Administration showed in the 1990s by aggressively pursuing energy efficiency and demand response programs *before* turning to new transmission. Build what we need, by all means, but show we really need it.

By making real gains in these areas BPA was able to reduce the amount of new infrastructure it needed and better make the public case for modernization and expansion of its system. They encountered less public opposition to transmission they truly needed. This was a valuable lesson and extremely relevant today. This approach is in fact a central part of FERC's Order 1000 transmission planning rule, which requires transmission planners to consider non-wires alternatives to meeting system energy and grid reliability needs.[11] Having a solid justification for building the lines is one way beneficiaries can be more easily identified and costs allocated fairly. This in turn should ease approval and cost recovery by state and local permitting and state utility regulatory authorities.

**Getting the most out of what we have**

Another major consideration in accomplishing modernization and expansion at least cost is utilizing the existing system better and building what we do construct today to meet both present and future needs. How can we take better advantage of existing transmission assets? Can the capacity transmission of corridors we have now be increased to avoid having to create new rights of ways? Can we optimize and operate the system more efficiently so variable resources can be more easily integrated, reserves and flexible capacity can be shared, and available transfer capacity freed up? As we phase out high carbon resources, such as uneconomic coal-fired power plants does that open up transmission capacity that can be used by cleaner energy resources? Then answer to these questions appears to be yes, but not always yes. In some cases new rights of ways will need to be established and transmission built. If we can plan and locate them to

[10] See April 2, 2014, *Gallup Politics*, "Americans Still Favor Energy Conservation Over Production, Americans look to conservation and renewable energy for solutions", http://www.gallup.com/poll/168176/americans-favor-energy-conservation-production.aspx

[11] For an in-depth look at the rule and its justification see: http://www.ferc.gov/industries/electric/indus-act/trans-plan.asp

avoid environmental and cultural resource conflicts the prospects for building them will be greater and recent tools including those developed at the Western Electricity Coordinating Council by their Environmental Data Task Force (EDTF) can help address these challenges at the planning level. [12][13]

**Recommendation:** DOE should integrate analysis of the risk of encountering environmental and cultural resources conflicts for transmission projects in its EPACT 2005 transmission corridor congestion and designation efforts, utilizing tools such as the WECC EDTF methodology and data viewer.

In the West, efficient grid utilization is constrained by the reliance on bilateral contracts instead of real-time energy markets, resulting in a costly and ineffective use of valuable assets. Sharing flexibility and contingency reserves is not easily done, and there is a risk of unnecessary development of gas-fired balancing resources and transmission. Situational awareness, the ability to see and understand conditions in neighboring parts of the system is in the process of being improved, but coordination of the system between grid operators is still far from optimal. There is not a single system or even a handful to coordinate, but many. Public utilities resist controlling with investor owned utilities, and Power Marketing Administrations struggle with grid coordination and modernization in the face of protests by their preference customers. Complicating matters further there are 38 balancing area authorities in the WECC footprint, each responsible for keeping the system synchronized and in balance between generation and demand in their respective control areas.

This balkanization is a well understood weakness in the Western grid. It needs to change but political concerns about control and responsibility continue to hamper progress in this area. WECC's Variable Generation Subcommittee has been studying the benefits of regional coordination, operational improvements such as 10 minute scheduling and balancing area consolidation. Major investments are being made in information technologies such as synchrophasors, providing real time information on system conditions and congestion, but the information is as yet not being fully taken advantage of. DOE played a major role in funding this work and has a stake in seeing better grid coordination as a result. Finally major progress in the form of the CAISO-PacifiCorp EIM could help improve this situation when the market goes live in October 2014. The market will facilitate renewable integration by providing access to and sharing flexibility reserves, providing geographic diversity to participating BAAs, and enhancing situational awareness and reliability for participants via the integrated control platform for the market. DOE should do all it can to encourage this reliability enhancing and cost-efficient market.

**Recommendation:** DOE should support existing and initiate additional efforts to consolidate and better coordinate balancing control areas and prioritize research related to integrated control architectures, information technologies and communications across the Western Interconnection, including the CAISO-PacifiCorp EIM..

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[12] Carl Zichella, Johnathan Hladik, "Siting: Finding a Home for Renewable Energy and Transmission, America's Power Plan," The Electricity Journal, Volume 26, Issue 8, October 2013, Pages 125–138

[13] For a summary see Western Electricity Coordinating Council, WECC 2013 Interconnection-wide Transmission Plan, pp 33 -34, November, 2013

DOE's Power Marketing Administrations (PMAs) also need to become part of the better coordinated transmission grid in the West and across the nation. In the West substantial portions of the grid are operated by PMAs. Under Secretary Chu DOE advanced a modest reform agenda in the form of "Joint Operating Team" (JOT) recommendations for grid coordination that provide a good start. These should be followed up on. Grid modernization cannot advance without PMA participation. Indeed utility participation in market reforms like the CAISO-PacifiCorp Energy Imbalance Market will require PMA cooperation. To its credit, BPA has signed a cooperation agreement with CAISO and PacifiCorp to assist with the first phase of the EIM, and the Western Area Power Administration (Western) can play a similar key role in facilitating the participation of other western utilities that will need their assistance in gaining access to transmission assets that allow them to trade in the EIM. Xcel Energy is one such utility that, if it chooses to participate in the EIM, would need to coordinate transmission access with Western.

**Recommendation:** DOE should follow through on grid coordination efforts involving PMAs, beginning with but not limited to the JOT recommendations.

**Recommendation:** DOE should encourage and direct PMAs to assist and collaborate with utilities seeking to participate in the CAISO-PacifiCorp EIM but which need access to their transmission systems to do so.

**Optimization and renewable energy zones**

Another important strategy to reliably integrate deep penetrations of renewable energy at least cost is to plan development and transmission together both to avoid resource conflicts and maximize the performance of the transmission system with variable generation sources. Forecasting –with both historical and current weather data – is one tool that can assist with this strategy as resource load shapes can be compared across broad geographies and variability aggregated to reduce the need for unnecessary balancing or flexibility resources and maximize transmission utilization.

One such tool has been privately developed by Northrop-Grumman using data from defense work performed for the U.S. Government. Called "MorePower" the system uses radar derived data to optimize placement of wind & solar installations to reduce variability impacts and maximize high quality power. In essence, renewable power can be located in resource zones using geographically specific information about when it operates to make the system operate more smoothly.[14]

Similar work on the system benefit of geographic diversity has been done by the University of Wyoming[15], the Midcontinent Independent System Operator, PJM and the National Renewable Energy Laboratory (NREL).[1617]

[14] For an overview of this system see: http://bit.ly/morepowerGN, slide 31,
[15] Jonathan Naughton, Thomas Parish, and Jerad Baker, Wind Diversity Enhancement of Wyoming/California Wind Energy Projects, Wyoming Infrastructure Authority, January 2013

Renewable resource zoning has been undertaken by numerous western states (among them California, Colorado, Nevada, Utah, Arizona), The Bureau of Land Management (Solar Programmatic Environmental Impact Statement), state-federal partnerships such as the Desert Renewable Energy Conservation Plan in California, the Western Governors Association, Argonne National Laboratory, and the Electricity Reliability Council of Texas to name the most important. None of these have captured all the beneficial locational factors in one place, however. Some have focused only on resource quality (Texas, Colorado), while others have added environmental factors (WGA, California, BLM, DRECP). The gap in all these approaches is the optimization of geographies for more efficient grid integration and operation of renewable energy resources.

**Recommendation:** DOE can facilitate this work by assigning NREL to work with state and regional planners to identify complementary resource zones that, when combined with environmental and cultural resource risk data, identify development areas for which transmission – either existing transmission which could be upgraded or new builds – should be prioritized.

## III: Conclusion:

Meeting America's electricity needs in this century will mean matching scale of the electricity and transmission system with present and future real world needs and conditions. As we plan operate, modernize and expand the grid we need to make sure current assets are being efficiently used, while resource conflicts and the construction of duplicative infrastructure are avoided.

Respectfully submitted by

Carl Zichella
Director of Western Transmission, NRDC
916-837-7127
czichella@nrdc.org

[16] D. Corbus, D. Hurlbut, P. Schwabe, E. Ibanez, M. Milligan, G. Brinkman, A. Paduru, V. Diakov, and M. Hand, California-Wyoming Grid Integration Study Phase 1—Economic Analysis National Renewable Energy Laboratory March 2014

[17] GE Energy Consulting, (2010). *Western wind and solar integration study, phase 1*, Retrieved from http://www.nrel.gov/ docs/fy10osti/47781.pdf.