

ESIG Webinar: Design Study Requirements for a US Macrogrid

Question	Answer
Who is going to design and validate a notional-wide Macrogrid operation organization and codes?	We can start with DOE and the national labs developing initial designs and engineering and technology verification, with industry input. Ultimately, industry members will need to be actively involved to flesh out many of the detailed design and operational issues.
Should energy scheduled on a Macrogrid be tied to individual mkts at the terminals or should it be based on energy optimization to maximize energy flow not \$\$\$?	At a high level, Macrogrid energy scheduling must coordinate with regional markets. One approach is that the national market takes bids and offers just like regional markets do. An important question would be who participates; one answer is "each region." However, actual details of energy scheduling for the Macrogrid will be designed to reflect market structures, institutional structures, resource mixes and operational needs ten to twenty years from now and need not be determined today.
VSC-HVDC multi-term=benefit of stabilising anchors of inertia & fault support - did you explore Gridform control or synchcomps/GFM batteries to guide HVDC control?	There is some control design literature for macrogrids available, but not much. But use of VSC-HVDC for inertia, voltage support, frequency stabilization is promising and needs to be further explored in the next phase of Macrogrid technical studies.
There's limited experience of operating 3 to 5 terminal systems (in China and Europe). How long it will take to realize "N" terminal systems?	Forever if we don't prioritize it. This is one of the technical challenges that the next phase of Macrogrid technical studies should address, and develop a plan for technical and operational verification of "N" terminal VSC-HVDC systems for Macrogrid application.
Who do you think would be liable for such a system? I assume the organisational structure to maintain such a system would be fairly complicatedA10	There are numerous options for ownership, operation and governance of a Macrogrid system, including the example of BPA as a federal power authority operating the Pacific DC Intertie and non-profit RTOs independent organizations operating the regional grids. These and other models should be studied and refined in the Macrogrid planning phase.
If the self-contingent system redistributes flows for loss of a DC terminal, will the underlying AC system need to be overbuilt at every DC terminal to handle that?	We don't think so. HVDC controls are very fast; remedial action schemes could be designed for these and other extreme events. However, the integration between the Macrogrid HVDC overlay system and the underlying AC system will need to be studied extensively and planned to address these and other important planning and protection questions.
Has there been any discussion on who would bear the cost of a Macrogrid or how the cost would be recovered?	There are several options including: (1) socialize the cost between state and federal governments; (2) allocate the cost according to benefits (calculated in a far different fashion than benefits recognition and cost allocation are practiced today); (3) develop public-private partnerships and hybrids to fund Macrogrid development and operation.

<p>Knowing there is a LOT of opposition when come times to build a knew line, what would happen to the Macrogrid if one leg of the grid is not built ?</p>	<p>There are benefits to partial Macrogrid development. Some partial builds would still be attractive, and some may not be. This would motivate building the Macrogrid in stages so that each stage adds operational and long-term value, enabling adjustment of plans for future Macrogrid stages and elements if individual legs are blocked.</p>
<p>Is ESIG responsible to design the national Macrogrid? What is the timeline to complete this?</p>	<p>ESIG is not responsible for designing the national macrogrid; ESIG sees its role as articulating the vision and need for a Macrogrid and advising industry and the federal government on desirable policy and technical elements associated with Macrogrid planning and development. There are design efforts ongoing at the national labs right now. There will need to be follow-on design efforts following these national lab studies.</p>
<p>Is it assumed that all the technology will be home-grown and home-built? Or do we expect this to be dependent on international equipment suppliers?</p>	<p>We do not assume that all Macrogrid technology would be domestically provided over the long term -- but it would make sense to ensure the US has the capability to supply initial and future needs associated with the Macrogrid development and construction.</p>
<p>Why stop with North America, or the continental USA? What about links to Europe via Iceland, or to Central and South America?</p>	<p>Interregional transmission development within the US is hard. Our priority is to address the immediate challenge of Macrogrid development for decarbonized energy systems within our own borders.</p>
<p>Is there a partial macrogrid option? i.e., Still benefit if only get partly through the national vision?</p>	<p>Yes, this is addressed in question 11 above. Every HVDC line that opens up additional clean energy development and improves delivery of clean, low-cost energy to customers should offer economic and decarbonization benefits, we expect that building out a large-scale, continent-wide Macrogrid with associated clean energy resource development will offer synergistic economic, reliability, resilience and decarbonization benefits that greatly exceed the benefits from partial Macrogrid development.</p>