Research Activities to integrate Solar and Wind

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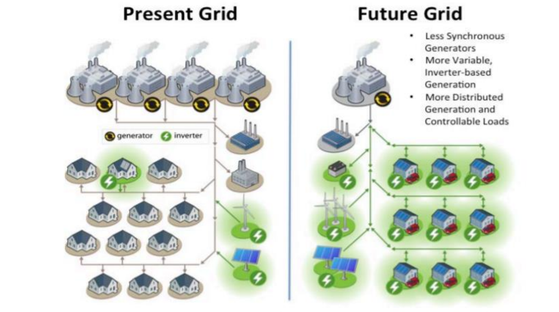
Project Intro

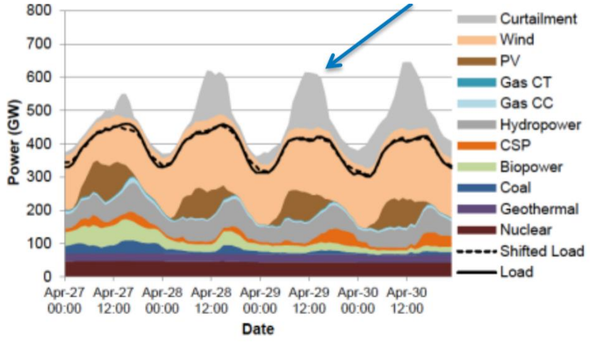
I first started thinking about solar and wind integration into the grid when I was asked to think of some sort of new technology during technical communications. My project involved integrating an effective solar recharge systems for vehicles much like what Fisker Karma tried to implement.

Which made solar and wind integration very appealing to me



- Variability and uncertainty of VRE
- Power system stability.

- Protection coordination
- Unintentional islanding
- Black-start capability.

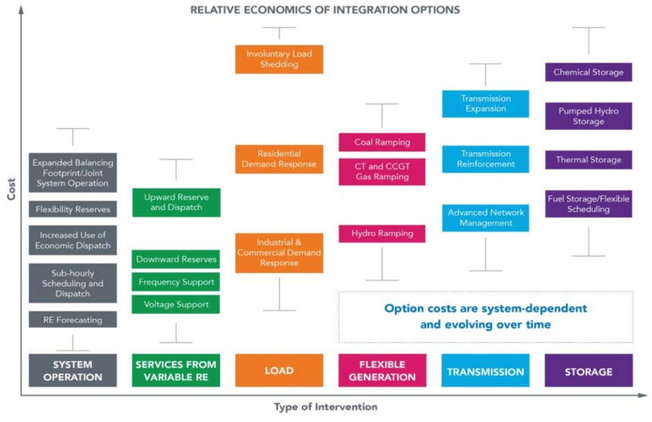


Ideas and discussion

Challenges
- Energy Shifting: VRE produces energy when resources are available-variable and uncertain
- Forecasting: renewable resources and load

Solutions
- Use geographic diversity
- Use flexible conventional generation
- Increase sharing among authority areas
- Expand transmission system
- Curtail excess VRE production
- Coordinate flexible loads
- Enhance VRE and load forecasting
- Add better electrical storage
- Interact with other energy carriers

Eventually we as a society will run out of fossil fuels and will require a new source of energy. The most beneficial thing would be to start fazing out fossil fuels and integrating renewable sources while we still have fuels to support impending problems with the integration.



Results

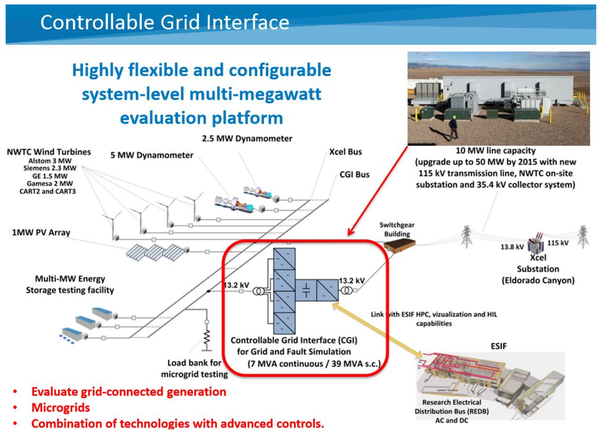
Further research needs in power systems to achieve 100% VRE:

<u>Technology</u>
- Advanced functionality embedded in wind and PV inverters needs to provide all grid services to maintain stable grid operations
- Grid codes and standards to enforce stability
- Cost effective energy storage methods

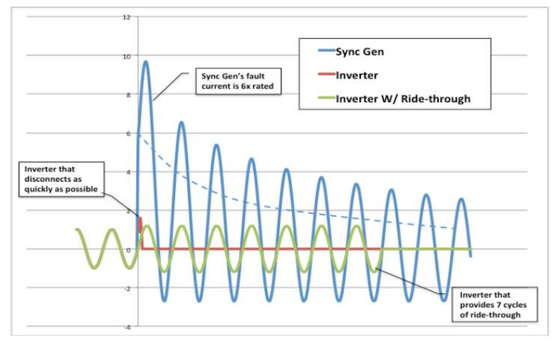
<u>Sensing, Measurement, and Forecasting</u>
- Improve solar/wind load forecasting
- Communications from measurements and data analytics for grid forecasting

<u>Power System Operations and controls</u>
- Algorithms and grid data use to make decisions for power system operations and control
- Transmission and distribution energy management systems need to be able to control millions of distributed devices

<u>Power system design and studies</u>
- Need for integrated transmission and distribution models to understand complexities and simulate both steady an-state dynamic conditions
- Need for models that tie the electric power grid to other energy infrastructures
- Need for models that incorporate various market designs



When I first started this project I believed it would be slightly easier to find a solution to this problem, or find an idea for the solution. At the end of this I suppose the solution was relatively simple however the technology and calculations behind these solutions are not. The technology of current day won't fully satisfy the gap that prevents the full conversion to renewable energy.



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