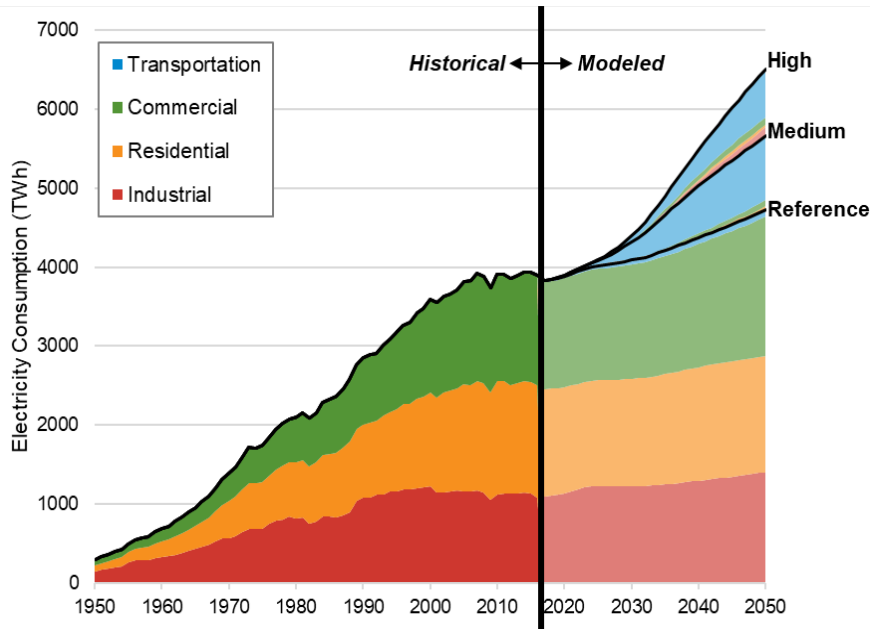




Medium Voltage Power Electronics Enabling DER and Increasing Climate Resiliency

Barry Mather Ph.D.
NREL

The Growing Electric Grid Opportunities

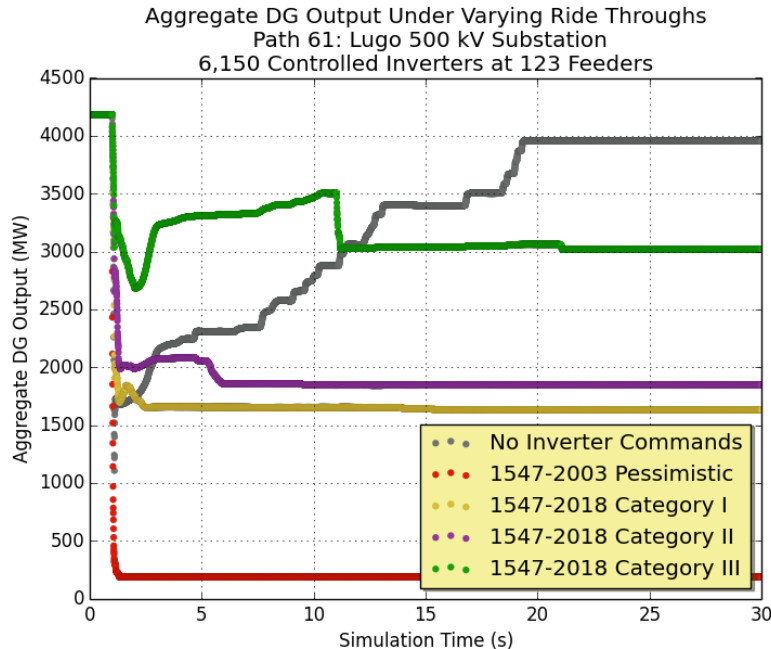


Electrification even before 2035/2050 goals was very significant

- Driven primarily by EV adoption forecasts and assumptions regarding steady electrification of residential, commercial and industrial sectors
- Ability to electrify is a key element to renewable generation-driven decarbonization

Source: NREL Electrification Future Study (EFS) – [nrel.gov/efs](https://www.nrel.gov/efs)

The Growing Renewable Grid Challenges



The specific operation of renewable generation within the system matters for overall reliability and resilience

- DER settings for LVRT, as defined in IEEE 1547-2018, are consequential and depend on regional/local grid conditions as well as DER penetration levels
- New ways to coordinate operation are needed to operate the grid as both decarbonization and electrification increase

Source: <https://www.nrel.gov/docs/fy20osti/73071.pdf>

Grid Forming Operation

EirGrid hits 70% variable renewable electricity instantaneous target

22 January 2021

Tackling climate change means changing the way electricity is produced and used and, as the Electricity System Operator, we have a key role in this transformation.

It is our responsibility to ensure a safe and reliable supply of electricity; but we also have a central part to play in delivering on our clean energy ambitions.

We are pushing the boundaries of the possible to integrate world leading amounts of electricity from renewable sources onto the power system, while carefully managing security of supply.

At times, the electricity powering homes and businesses can be made up of up to 65% wind and solar, but we need to increase this and so we are now trialling 70% of electricity from variable renewable sources at any one time.

This is a significant engineering challenge and as such it is a work in progress, but we are pleased to say that we hit that target last weekend.

Our trial will last three months and during this period, we will be challenging ourselves and our systems to consistently operate at 70% when there is enough variable renewable energy available, to allow us to do so.

While the energy transition is underway, we will still rely upon a mix of generation sources to allow us to maintain the secure and high quality supply that consumers expect.

This is a positive development and is evidence of our commitment to transform the power system for future generations.

We're stepping up.

The designed operation of many renewables has assumed that they would not become a major share of our power system

- “Grid-following” technology is ubiquitously used for all DER and even huge transmission connected wind and solar plants
- To operate the future grid, new control technology is needed

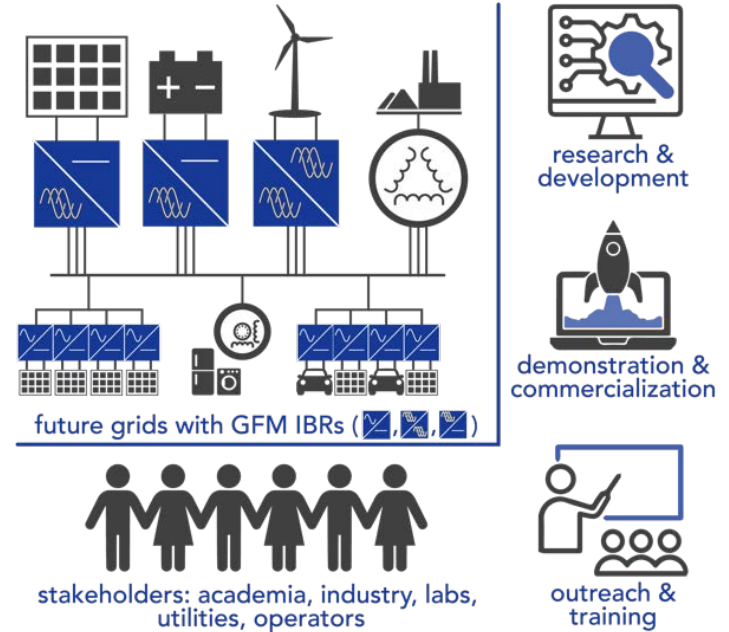
UNIFI

The **UNIFI Consortium** is a forum to address fundamental challenges in seamless integration of grid-forming (GFM) technologies into power systems of the future

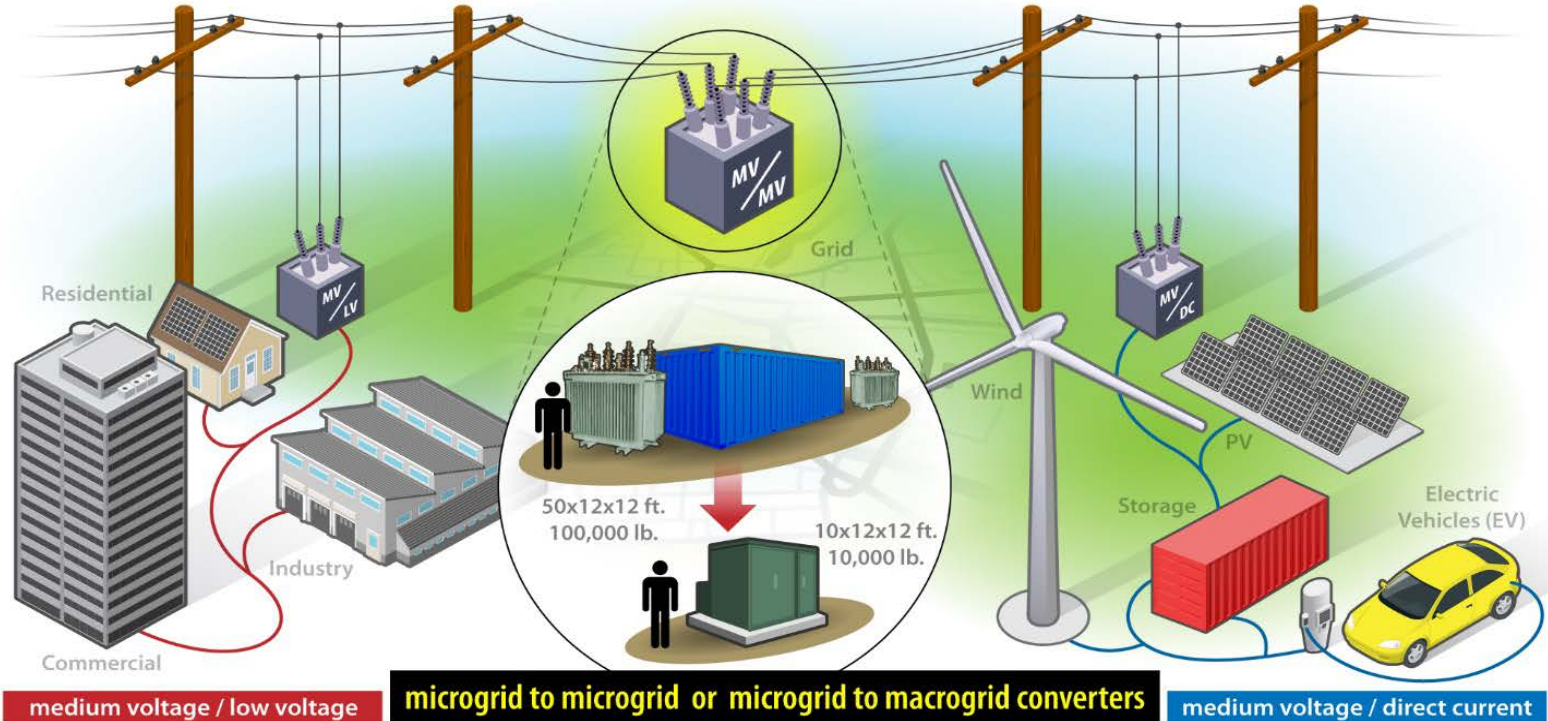
Bringing the industry together to unify the integration and operation of inverter-based resources and synchronous machines

Three major focuses:

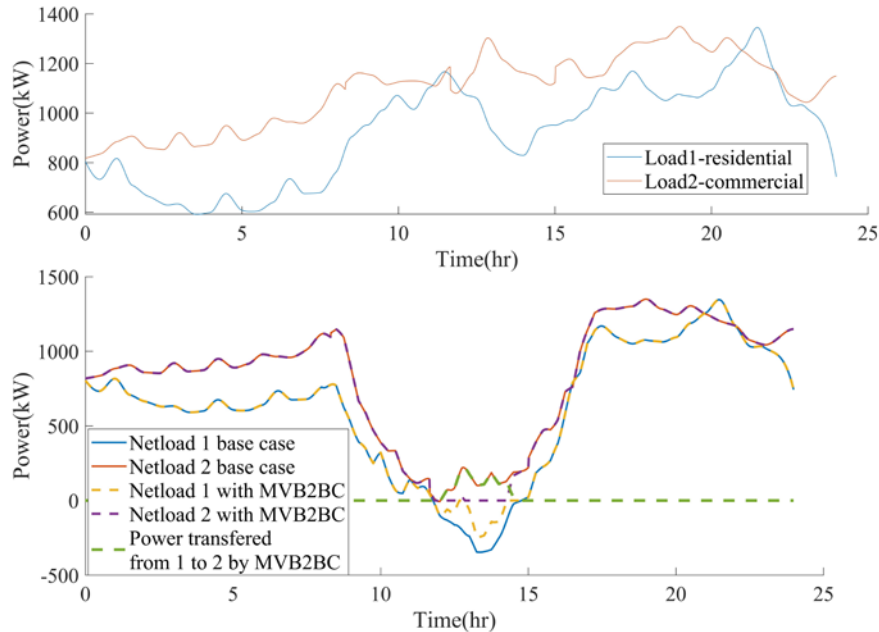
- Research & Development
- Demonstration & Commercialization
- Outreach & Training



MV Direct-Connection



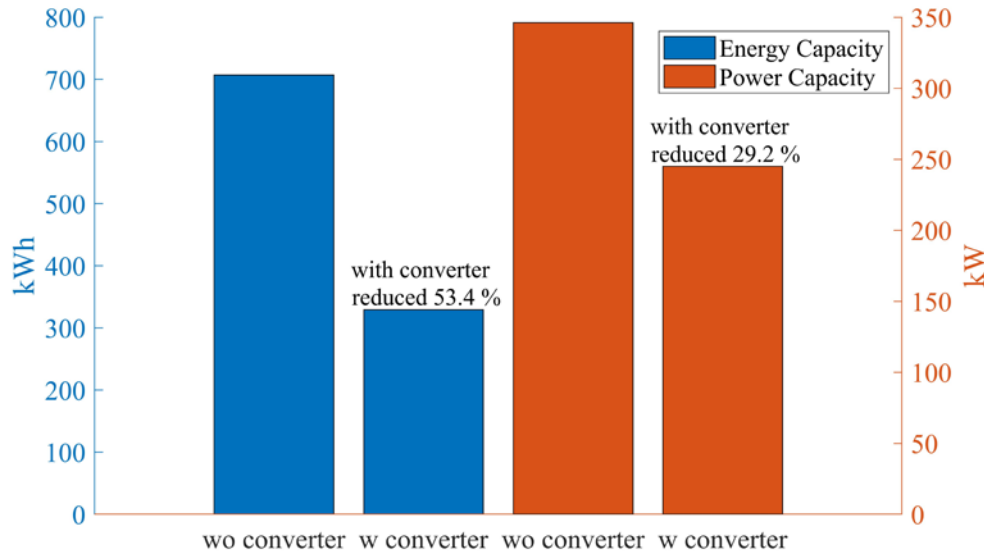
Demonstration of Value



Even modest sized inertie converters can provide significant value

- Dramatically increase solar PV DER hosting capacity
- Avoid costly re-conductoring/new circuit builds
- Greatly reduce energy storage requirements to mitigate PV curtailment

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- Avoid costly reconductoring/new circuit builds
- Greatly reduce energy storage requirements to mitigate PV curtailment
- Enables many more “use cases” related to resilient operation of the dist. system



Thank you for your attention

Barry Mather –
barry.mather@nrel.gov

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