

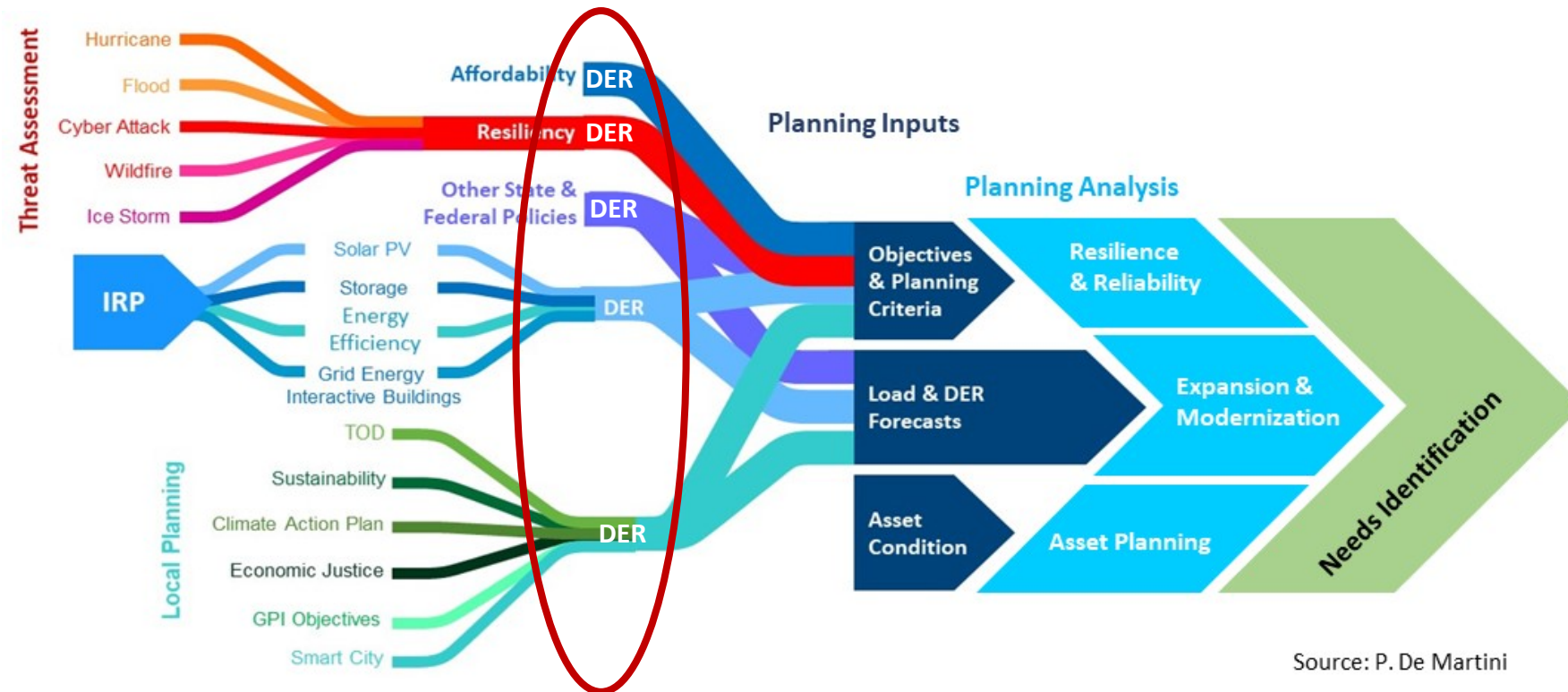
T/D/C Operational Coordination

Electricity Advisory Committee Meeting

October 21, 2021

Wholistic View of DER Services

Operational Coordination of DER that may provide a range of services at different tiers of the system requires a different paradigm than has been used to-date in the US and Globally



Source: P. De Martini

DER is being used at the Edge, Distribution & Bulk System to address many of these needs that each have unique service requirements

UK Open Networks

UK effort is now 5 years old and there are no tangible results in terms of implemented T-D operational coordination models for demand response

- Focus on enabling “Flexibility Markets” for distributed resources
- Flexibility markets refers to:
 - Demand response participation in wholesale grid services
 - Demand response for distribution capacity deferral only (non-wires alternatives)
- UK appears to be several years behind the US on the use of demand response in wholesale and distribution services
- UK doesn’t appear to be considering coordination issues with export energy from distributed resources at this time
- UK did not do any grid architectural assessment or cybersecurity risk analysis of the various models
- Program didn’t reach a conclusion – left details for each DNO to work out. Subsequent DNO analysis is underway. ENA is about to release an RFP for additional TSO-DSO consulting support

“We have zero alignment of DSO markets and wholesale markets in the UK (for now). It's a really hard nut to crack. If you try and start there.....you may never get off the ground” ENA March 2021

Australia Open Energy Networks

Process reached a dead-end due to significant conflict between AEMO, ENA and stakeholders regarding the final analysis and recommendations over roles & responsibilities

- Focus of the initiative was:
 - System security given the rapid growth of large-scale renewables and DER
 - Enabling DER to provide distribution and wholesale services (Value Stack)
 - Examine alternative operating mechanisms (e.g., operating envelopes)
- Initiative conducted as a business process reengineering/IT preliminary engineering effort.
 - Visioning alternative T-D coordination models – capabilities & functions
 - Enterprise Architecture based approach to determining information flows & technology (Smart Grid Architecture Model – SGAM)
 - Cost-effectiveness – assessing the cost-effectiveness of each of the market models (separate consultant)
- ENA concluded in its position paper that no material changes were needed until 2039
- Federal regulators are trying to revive the effort

Lessons Learned

- Top down approaches to determine operational coordination of DER do not work
- Details matter regarding the specifics of services, performance requirements and reconciliation of anticipated multiple uses of DER
- Focusing only on near-term coordination issues risks making poor decisions in relation to the larger and more complex coordination needs later this decade – we are already behind
- It is essential to distinguish DER compensation methods from operational mechanisms – these are not the same thing, but are complementary
- Operational coordination includes edge devices and unregulated services to meet customers' needs. Most of the DER are theirs or primarily to serve them – not the power system - any coordination framework needs to address the “Customer”

Need to Identify Services & Related Operating Mechanisms

Operating Mechanisms are the methods to initiate a real-time operational response from a resource

- Each service has a “Compensation” method and an “Operating Mechanism”
- Operating mechanisms include Price formation (e.g., LMP), Direct physical control (e.g., AGC, AC Cycling) & Autonomous (e.g., Volt-Watt in inverters, Droop Control)
- “Value stacking” involves various bundles of services for specific applications with different operating mechanisms at different tiers in the system
- These combinations require deeper examination in relation to the interrelationship of operating mechanisms and related actors and operational interchanges.
- This is an essential prerequisite to assessing structural changes.

	Bulk System	Bulk <-> Dist	Dist System	Edge <-> Dist	Edge<->Edge	Edge (BTM)
Services						
Energy Supply						
Energy Transport						
Energy Storage						
Managed Energy Consumption						
Frequency Regulation						
Voltage/Reactive Power Regulation						
Energy Reserves						
Resilience						

Value Stack Bundle Examples

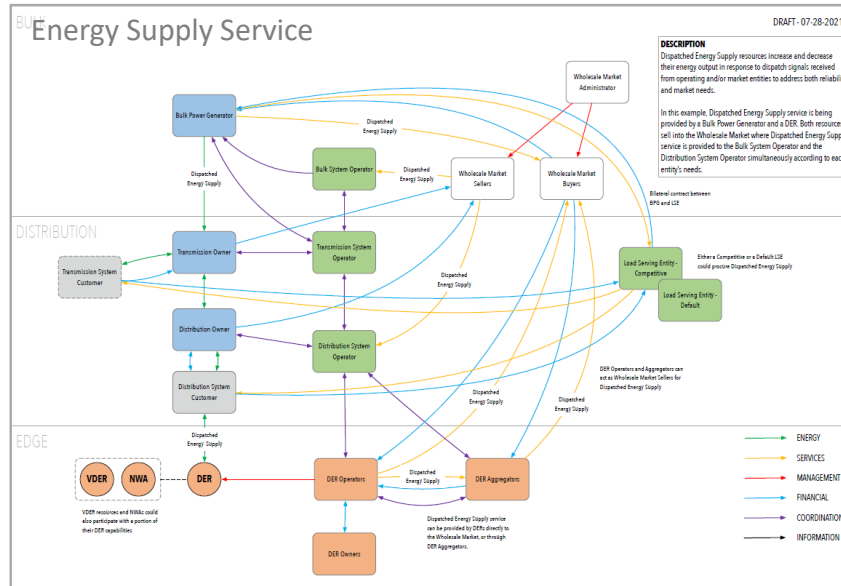
Virtual Power Plant

- Edge:
 - Autonomous energy supply
- Edge to Distribution
 - TOU or Dispatched load reduction services
 - Autonomous voltage/Var services
- Bulk Power
 - LMP based energy supply
 - Dispatched capacity service
 - Dispatched frequency service

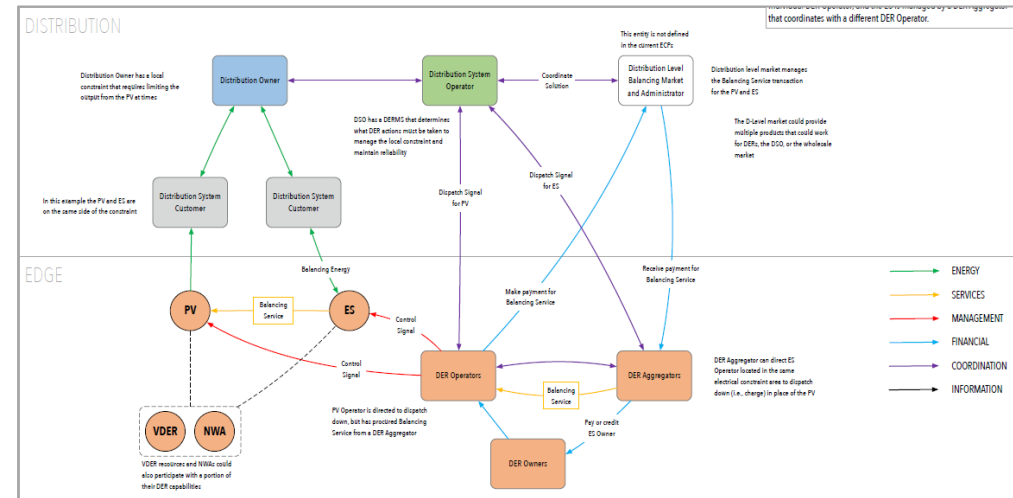
Community Microgrid

- Edge:
 - Autonomous energy supply
- Edge to Edge:
 - Dispatched energy supply
 - Autonomous voltage regulation
 - Dispatched resilience service
- Edge to Distribution:
 - Dispatched Capacity services
- Bulk Power:
 - LMP based Energy Supply

Develop Coordination Structures & Resolve Operational Conflicts



Distribution Balancing Service



Source: Concentric Energy Advisors

- Develop coordination structures for each discrete service associated with each operating mechanism
- Identify actors, information and timing requirements
- Evaluate the resulting “stack” of structures to resolve the resulting coordination conflicts

Operational Coordination Architecture Method (OCAM)



1. Identify Objectives & Constraints
2. Identify Specific Services & Related Operational Mechanisms
3. Develop Coordination Structures & Reconcile Coordination Conflicts (apply Grid Architecture)
4. Document Existing/Emerging Industry Structure
5. Develop Transition Plan

Considerations

Need to enable regulators and industry to create operational coordination structures to effectively orchestrate a wide diversity of clean and distributed resources at the edge to bulk power system

- What are the DER services anticipated over the next 10+ years at each tier of the power system?
- What operating mechanisms are appropriate given the operational requirements (e.g., timing) for each service?
- What are the required edge grid codes for DER to fully participate?
- What operational coordination conflicts arise when “stacking” services from the same resource or aggregated resources (e.g., pricing vs direct control vs autonomous vs independent)?
- What level of regulatory coordination & oversight is needed to ensure safe, effective operation across edge to bulk power system?

