



Distributed Energy Resources in PJM Transmission / Distribution Interface

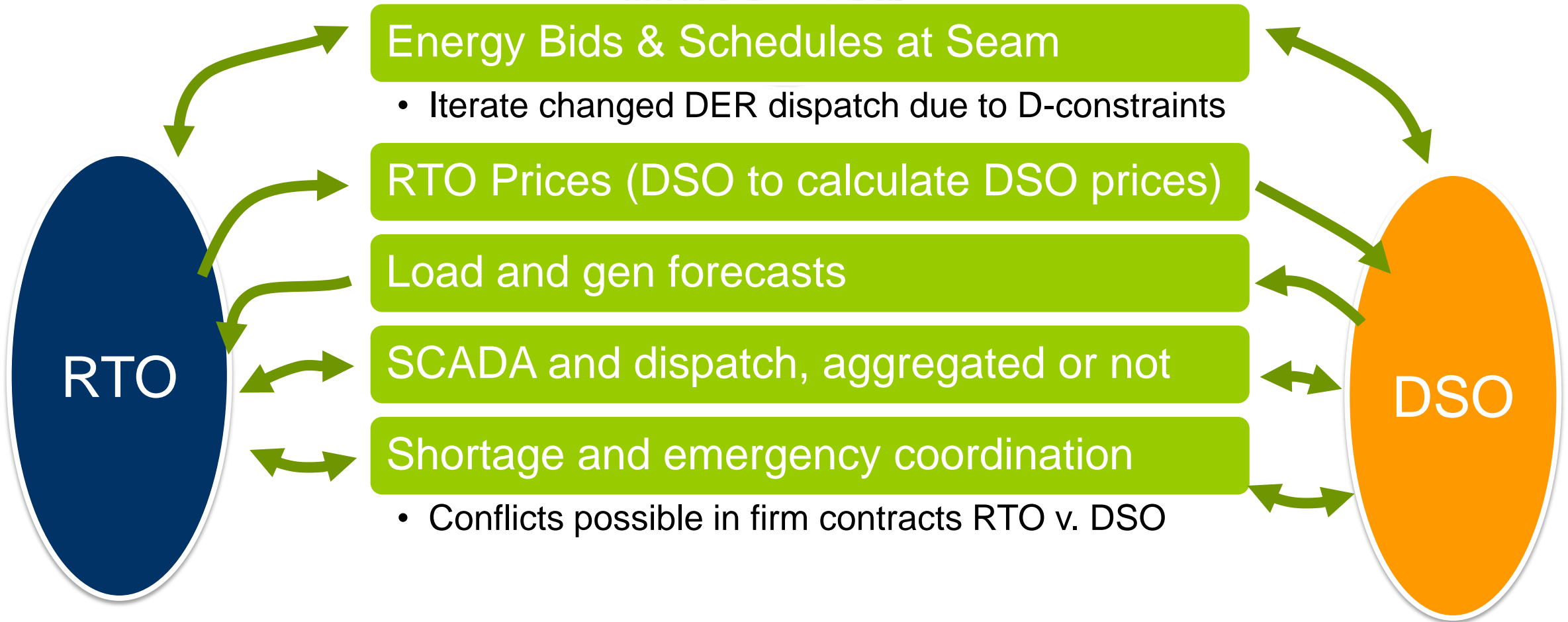
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- Regulatory
- Multi-state jurisdiction (15 jurisdictions)
- DSO - add value but don't compete with members
- Independence
- Tariff / rate model
- visibility

1. **Visibility** for reliability
 - Emergency operations, event analysis

2. **Measure** and **forecast** DER interaction with the grid
 - Market and Ops; Settlements; Planning

3. If possible, **incent** DER to interact for reliability and value
 - Optimize the use of DER to achieve reliable and efficient grid operations



- Today PJM has limited **visibility** into the operation of Distributed Energy Resources (DER).
 - DERs that are aggregated by the EDC, LSE or CSP participate as generation or Demand Response in energy, capacity or ancillary service markets
 - General awareness of location (but not operation of) additional DER not in wholesale market through tools like the Generator Attribute Tracking System and Dispatch Interactive Map Application
 - Monitoring and control in some area down to 12kV

Dispatch Interactive Map Application (DIMA)

- Multi-search
- Advanced Substation Panel
- Gas Layer
- Generation Layer
- Transmission Outages

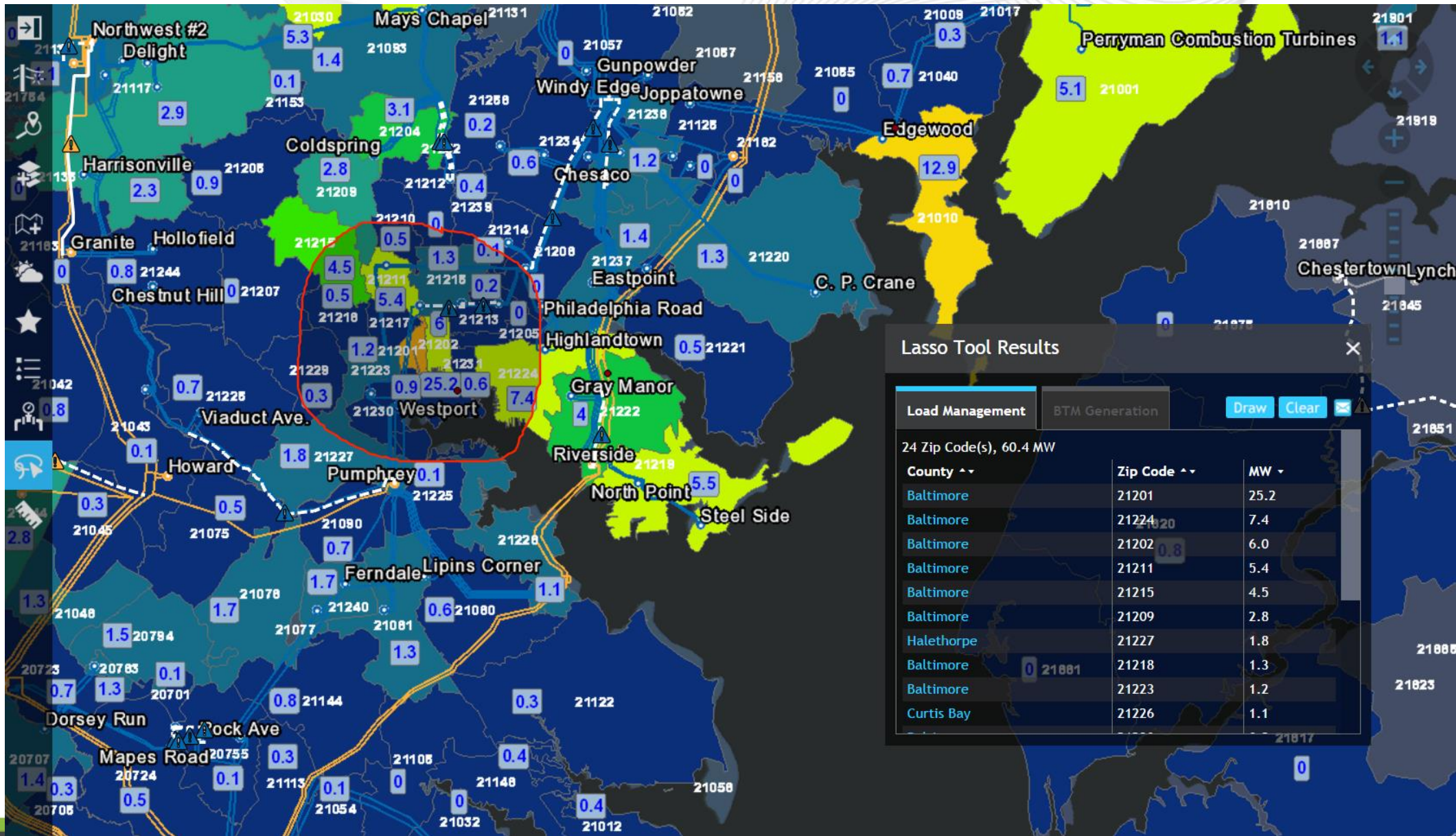
The screenshot displays the DIMA application interface with several key components:

- Line Outages Panel:**
 - Color-coded legend for outage counts: All (69), 115, 138, 161, 230, 345, 500, 765, DC.
 - Outage State: Out of Service, Outage State.
 - Outage Full Duration: [Solid line]
 - Outage Not Full Duration: [Dashed line]
 - Outage No Ticket: [Dotted line]
 - Unknown: [Dash-dot line]
- Search Results:**
 - Belmont
 - Pruntytown
 - Mountaineer
 - Harrison
 - Clear All
 - Add
- Lasso Tool Results:**
 - Load Management | BTM Generation | CSV
 - 5 Zip Code(s), 6.2 MW

County	Zip Code	MW
Buckhannon	26201	3.0
Elkins	26241	1.8
Philippi	26416	1.2
Parsons	26287	0.2
- Substation Detail Panels:**
 - Salem (New Jersey) 500 kV:**
 - Facility ID: SALENJ500
 - Zone: Public Service Electric and Gas Company
 - Generators (3): LIMERICK 1 (Nuclear, 1,000 MW), LIMERICK 2 (Nuclear, 1,100 MW), LIME 1 (CT, 80 MW).
 - Equipment: Capacitors (2), Reactors (8), Gas Pipelines (3).
 - Limerick (Pennsylvania) 500 kV:**
 - Facility ID: LIMPA500
 - Zone: PECO Energy Company
 - Generators (3): LIMERICK 1 (Nuclear, 1,000 MW), LIMERICK 2 (Nuclear, 1,100 MW), LIME 1 (CT, 80 MW).
 - Equipment: Capacitors (2), Reactors (8), Gas Pipelines (3).
 - Cromby (Pennsylvania) 230 kV:**
 - Facility ID: CROMPA230
 - Zone: PECO Energy Company
 - Generators (3): LIMERICK 1 (Nuclear, 1,000 MW), LIMERICK 2 (Nuclear, 1,100 MW), LIME 1 (CT, 80 MW).
 - Equipment: Capacitors (2).
- Outage Lists:**
 - Outages visible on the map:**

status	name	kV	zone
■	502 Junction - Harrison	500	APS
■	502 Junction - Kammer	500	APS, AEP
■	Arsenal - Brunot Island	345	DL
■	Arsenal - Logan's Ferry	345	DL
■	Avon - Beaver	345	ATSI
■	Avon - Beaver	345	ATSI
■	Bath County - Valley	500	Dominion
■	Bay Shore - Davis-Besse	345	ATSI
■	Bay Shore - Monroe (DETED)	345	ATSI
■	Beaver Valley - Hanna	345	DL, ATSI
 - Outages off the map:**

status	name	kV	zone
■	138th Street - Bethany	138	DPL
■	Alburtis - Wescosville	500	PPL
■	Alburtis - Branchburg	500	PPL, JCPL



- The ability to **measure and forecast** all DER would enable the grid operator to know the amount, timing, and location of generation injected into the grid and/or load reduced from the grid.
 - This will enhance regional grid operations and least-cost regional dispatch solutions for the regional wholesale market.
 - Additionally, factoring the operation of DERs into long term transmission expansion planning will result in more efficient plans.
 - Impacts load forecast (as DER reduces load needing to be served by grid) and the location and design of transmission (as DER may inject power or reduce load to support grid reliability)

- Coordination and alignment of the retail rate and wholesale rate will **incent** operational performance of DERs to achieve maximum reliability and market efficiency benefit achievement from DER deployment.
 - Wholesale market prices signal when the regional grid needs resources to operate or reduce electric consumption to meet demand as system conditions change.
 - Closer alignment of prices will support regional grid reliability and wholesale market efficiency, reducing wholesale costs.
 - The foundation for the wholesale retail pricing alignment is AMI technology capable of sending price signals in time intervals that track wholesale market signals.

Total Storage in the Regulation Market: **270 MW**

PJM Grid Connected Storage: **265 MW**

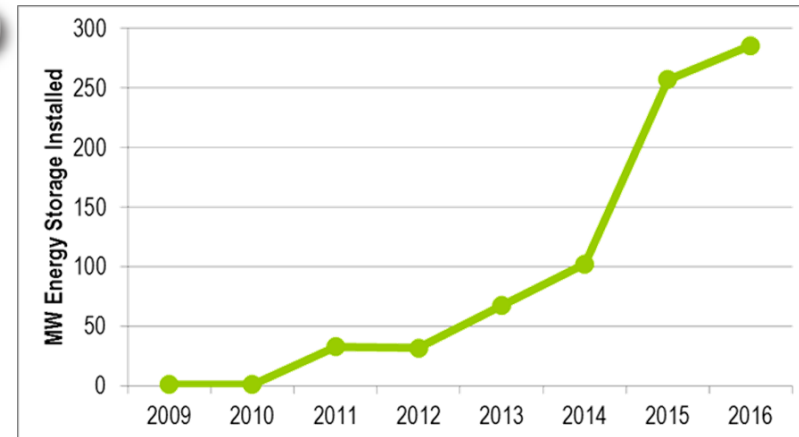
Behind the Meter Storage: **5 MW**

Distribution Voltage
(12kV-34.5 kV),
110 MW

Sub-Transmission Voltage
(>34.5 kV and <100 kV),
40 MW

Transmission Voltage
(>100 kV),
115 MW

Demand Response,
5 MW



Updated: 6 April 2016