On-Site Generator (DER) participation as Economic DR resource
• CSP must accurately complete DR Hub information (see following slides) for On-Site Generator
  – This information is captured for each location before it is registered as Economic DR or Emergency/Pre-emergency DR
  – Only load reductions from generator output that would not have otherwise been operating are eligible for Economic DR energy settlements.

• CSP may only submit registration if CSP has all appropriate environmental permits. By virtue of submitting a registration, CSP represents that CSP has validated that customer has all appropriate environmental permits.
  – Necessary permits must be in place before effective date on registration – if the CSP has not received the necessary permits prior to indicated effective date, then CSP must terminate such registration before effective date.

RRMSE score below 20% does not mean location may participate
### On-Site Generator

<table>
<thead>
<tr>
<th></th>
<th>DR Source</th>
<th>Example</th>
<th>Permitted Participation as Economic DR energy Resource</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Generation</td>
<td>On-site backup generation – does not run except for emergency to supply power or for normal routine testing. Historic output shows only used during routine test.</td>
<td>Yes. Normal operational generator test do not qualify. Only time test would qualify is if test is NOT scheduled and then unit is used to support RT or DA instructions.</td>
</tr>
<tr>
<td>2.</td>
<td>Generation</td>
<td>Cogen/CH&amp;P (Central Heat and Power). Unit runs as part of normal production process and output will remain comparable whether or not there is participation in PJM economic DR.</td>
<td>No.</td>
</tr>
<tr>
<td>3.</td>
<td>Generation</td>
<td>Cogen/CH&amp;P or unit that operates historically to reduce electricity cost but will operate for more hours or higher MW per hour because of PJM economic DR revenue.</td>
<td>Maybe – can only participate if PJM can quantify the incremental load reductions.</td>
</tr>
<tr>
<td>4.</td>
<td>Generation</td>
<td>Cogen/CH&amp;P or unit that operates to shaves peak each month.</td>
<td>No unless there is incremental MW or MWh that will occur.</td>
</tr>
<tr>
<td>5.</td>
<td>Generation</td>
<td>Unit(s) that have interconnection agreement (ISA/WMPA) to inject power.</td>
<td>Maybe – must also consider whether or not unit would operate just for injection.</td>
</tr>
</tbody>
</table>
• PJM will need to evaluate each registration to determine if feasible to quantify incremental output.
• CSPs must accurately designate Load Reduction method and associated Generator parameters in DR Hub:
  – Back up only = Yes, generator has not run historically and will only run if PJM dispatches or clears in the market.
  – Back up only = No, generator does typically operate and therefore PJM needs to determine if incremental output because of Economic DR energy revenue can be quantified.
    • CSP should send PJM 1 year historic generation output and associated marginal costs
    • CSP may propose method to quantify incremental output.
    • Historic on-site generation output variability will determine if incremental output is predictable.
Process to administer On-Site Generation PJM approval

<table>
<thead>
<tr>
<th>Load Reduction Method</th>
<th>Generator Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing (kW)</td>
<td>ID</td>
</tr>
<tr>
<td>Lighting (kW)</td>
<td>Name</td>
</tr>
<tr>
<td>HVAC (kW)</td>
<td>Non-Retail BTMG</td>
</tr>
<tr>
<td>Water Heaters (kW)</td>
<td>Max Output (kW)</td>
</tr>
<tr>
<td>Refrigeration (kW)</td>
<td>Nameplate (kW)</td>
</tr>
<tr>
<td>Plug Load (kW)</td>
<td>Backup Generator Only</td>
</tr>
<tr>
<td></td>
<td>Generator Type</td>
</tr>
<tr>
<td></td>
<td>Fuel Type</td>
</tr>
<tr>
<td></td>
<td>Vintage</td>
</tr>
<tr>
<td></td>
<td>Retrofit Year</td>
</tr>
<tr>
<td></td>
<td>Permit Status</td>
</tr>
<tr>
<td></td>
<td>Permit Type</td>
</tr>
<tr>
<td></td>
<td>EIA 860 Plant Code</td>
</tr>
<tr>
<td></td>
<td>EIA 850 Generator ID</td>
</tr>
<tr>
<td></td>
<td>Note</td>
</tr>
</tbody>
</table>

Click “I” button to input Generator attributes

Select “Add Generator” button

Click the “Add Generator” button.
Process to administer On-Site Generator PJM approval

- Fill out Generator Dialog box, especially note the ‘Backup Generator Only’ selection:

- Select ‘Yes’ for ‘PJM Only’ generator, or ‘No’ for ‘Incremental’ generator – then click Save:

  Yes = PJM Only
  No = Incremental
DER with injection capability registration process requirements
Load reductions operate as a DR, Injections operate as a generator

- At the time of registration CSP will notify PJM if the generator is interconnected to allow injections onto the transmission and distribution system.
  - The CSP will designate as: “none”, “ISA”, “WMPA”, “NEM”, “PURPA QF” or other.
- If the existing (registered) DR generator gets interconnected, the CSP will notify PJM as soon as possible and will request CBL review if generator will participate as an Economic DR resource in the energy market.
  - Load reductions done in order to inject power onto the grid are typically (but not always) considered part of normal operations and therefore not eligible for Economic DR settlements.
- If On-Site Generator has ISA, WMPA then CSP will also provide:
  - the PJM reference to the generator and the amount of injection rights;
  - Ensure appropriate telemetry is in place at the point of interconnection and the On-Site Generator, and as outlined in Manual 14D;
  - Manage the DR offers to reduce load and/or Generation offers to inject power in the wholesale markets based on the actual generator capability. CSP will make sure that the total offer amount for the modelled resources will not exceed the capability for the generator. All regulation offers will be made through the DR modelled resource or as otherwise approved by PJM.
    - Technically, 2 different members may manage but this requires close coordination.

Currently CSP should use dsr_ops@pjm.com email to notify PJM of above. PJM will add new fields in DRHUB to capture this information in the future.
– DR Hub | Registration
  • CSP to Select CBL and conduct RRMSE test
  • If On-Site Generator will be solely used for economic DR and would not have otherwise operated then it can participate as economic (you do not need to do anything else)
  • For “Incremental Generator” (Backup Only = No, in DR Hub), CSP must Submit CBL review (even if CBL passes RRMSE test)
    – Select “Other” for reason and include comment “On-Site Generator = Incremental Generation ”
    – CSP should email dsr_ops@pjm.com 1 year of historic generator output and marginal cost for unit. Please see following slides for details.
    – If multiple generators, we will need to discuss best way to provide the historic data
  • PJM will review the registration and approve if incremental load reductions can be quantified, otherwise registration will be denied

Please email dsr_ops@pjm.com if you have questions or would like to discuss associated details.
### Incremental Generator supporting information

#### Simple example

<table>
<thead>
<tr>
<th>RegID</th>
<th>Date</th>
<th>HE</th>
<th>Gen Output (MW)</th>
<th>Fuel Cost ($/mwh)</th>
<th>Maintenance Adder ($/mwh)</th>
<th>Cost ($/mwh)</th>
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<td>24</td>
<td>-</td>
<td>$49.00</td>
<td>$2.00</td>
<td>$51.00</td>
</tr>
</tbody>
</table>
For CHP, 2 cost points are required.

Cost to run CHP with heat utilization is intended to show cost when the heat produced by the unit is being utilized for a facility needs.

Cost to ramp up CHP with heat wasted is intended to show cost of running the unit at higher output after heating needs are satisfied and excess steam is being wasted.

PJM/CSP will need to work through all the details based on the application
How to determine incremental output for On-Site Generator

- **Simple** – wholesale price (LMP) < marginal cost, only reason generator operates is because of Economic DR wholesale market revenue

- **Cogen** – need to evaluate based on steam needs, stand alone boiler capability, etc. Quantify marginal cost when steam used for facility vs marginal cost when steam is not used.
  - Eligible for additional MWs between 2 cost points ($30 <> $90 on prior slide)

- **Generator with injection rights (WMPA, ISA)** – Typically, only eligible for Economic DR energy revenue in hours when generator does not inject power unless:
  - PJM and CSP finalize below before PJM will consider Economic DR settlements in same hour as injection
  - Required gen revenue (Total Gen output * marginal cost) – Gen Export Revenue (Gen Export output * LMP) – implied retail savings (Gen load reduction MWs * retail rate) < $0
    - If Generator is also a Capacity Resource (“front of the meter”) for injection and is dispatched by PJM then Economic DR is not eligible for same interval.

- **Retail Price** includes all avoided retail cost (generation, transmission, distribution, based on energy and/or demand type charges)
  - Will consider use of retail price (instead of wholesale price), for Simple and Cogen described above if it can be accurately quantified.
DER with injection capability offer process

Day Ahead Market
1. Generator is offered to DA Market for Injection as a Unit (required if has Capacity Resource commitment or optional otherwise).
2. Generator is offered to DA Market for load reduction as DR (optional)
3. If Unit's DA offer is cleared then the Economic DR resource will not be settled for same hours or incur BOR. CSP must notify PJM of this situation and then PJM will ensure there is no settlement for such time period. If Unit's DA offer did not clear then cleared Economic DR resource will be settled.

Real Time Market
1. If Unit cleared in DA market, then wait for PJM dispatch of gen unit. No Economic DR activity (DA or RT) for the same hours.
2. If Unit did not clear in DA market, and Economic DR did clear in DA market then perform the load reduction in RT market. Typically (but not always), Economic DR settlements are not eligible if generator exports in RT market as a Unit in the same hour.
3. If Unit resource did not clear in DA market, and Economic DR did not clear in DA market than Economic DR settlement are eligible when dispatched by PJM and typically when the generator is not dispatched in RT market as a Unit in the same hour.
**DER with injection capability - Example**

- **Generator nameplate**: 10MW
- **Load**: 4MW
- **Cost to run generator**: $50/MW
- **Retail rate**: $45/MW
- **NBT**: $23.99

**Begin**

- **Generator is offered to DA Market for Injection as a Unit = 6MW @ $50/MW for HE 10;**
- **Generator is offered to DA Market for load reduction as DR = 4MW @ $24 for HE 10;**

**Cleared in DA as DR for HE 10?**

- **yes**
  - Settles in DA as DR
  - LMP = $30;
  - Net Benefit = ($30+$45-$50)*4MW = $100
  - Not eligible for DR energy revenue

- **no**
  - CSP notifies PJM. PJM cancels DR settlement

**Cleared in RT as a Unit for HE 10?**

- **yes**
  - Cleared in RT as a Unit for HE 10?
  - **yes**
    - Cleared in RT as DR for HE 10?
    - **yes**
      - End
    - **no**
      - LMP = $30;
      - Net Benefit = ($30+$45-$50)*4MW = $100
    - **no**
      - LMP = $60;
      - Net Benefit = $60*6MW - 50*10MW + $45*4MW = $40
  - **no**
    - Not eligible for DR energy revenue

- **no**
  - Cleared in DA as a Unit for HE10?
  - **yes**
    - LMP = $30;
    - Net Benefit = ($30+$45-$50)*4MW = $100
  - **no**
    - LMP = $60;
    - Net Benefit = $60*6MW - 50*10MW + $45*4MW = $40

**CSP notifies PJM. PJM cancels DR settlement**

- **Generator is offered to RT Market for Injection as a Unit = 6MW @ $50/MW for HE 10;**
- **Generator is offered to RT Market for load reduction as DR = 4MW @ $24 for HE 10;**

**Cleared in RT as a Unit for HE 10?**

- **yes**
  - Cleared in RT as DR for HE 10?
  - **yes**
    - End
  - **no**
    - LMP = $30;
    - Net Benefit = ($30+$45-$50)*4MW = $100
  - **no**
    - LMP = $60;
    - Net Benefit = $60*6MW - 50*10MW + $45*4MW = $40

**Cleared in DA as DR for HE 10?**

- **yes**
  - LMP = $30;
  - Net Benefit = ($30+$45-$50)*4MW = $100
- **no**
  - LMP = $60;
  - Net Benefit = $60*6MW - 50*10MW + $45*4MW = $40