

Getting to Diesel-Off

Technical requirements

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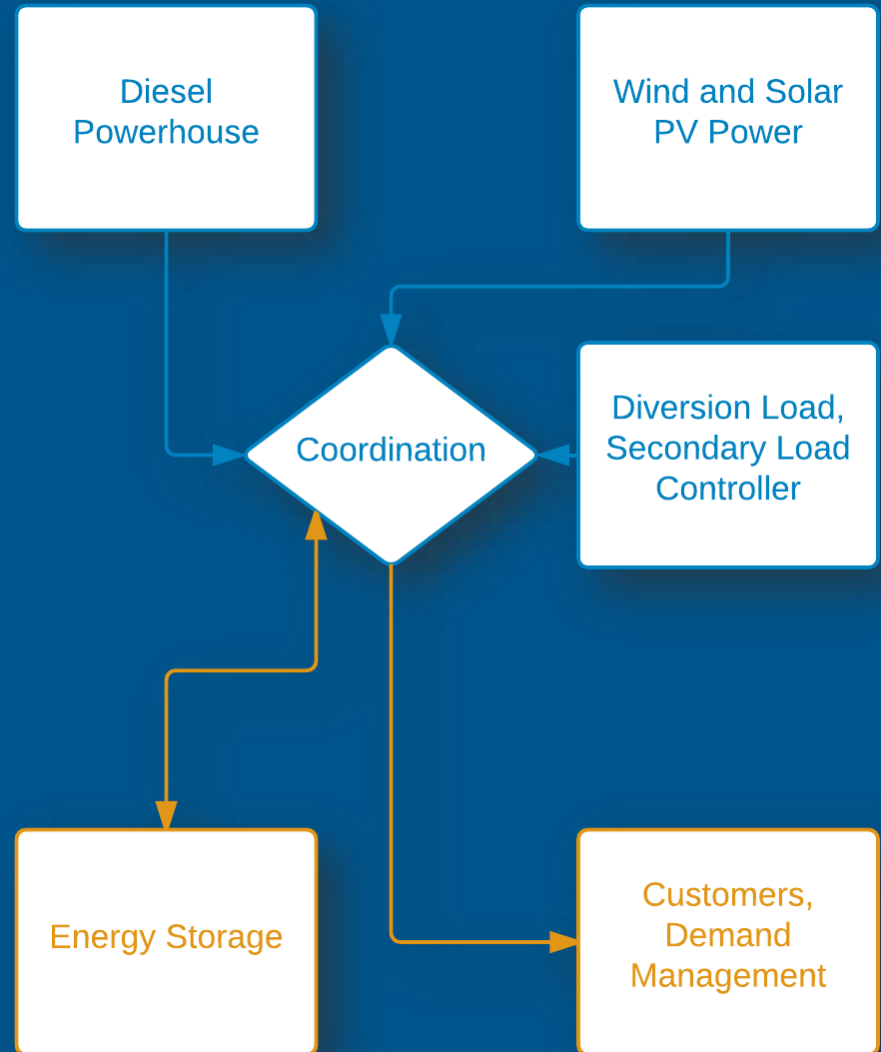
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Why Diesel-Off?

- Increase renewable power utilization
- Minimize carbon footprint
- Hedge against fuel price volatility
- Reduce diesel O&M



Services provided by diesels

- ‘Form the grid’
 - Provide Voltage and Frequency reference
- Inertia
 - Can ride through minor disturbances
- Provide spinning reserve capacity
 - Backstops drops in renewable power
 - Backstops increases in demand
- Fault current/clearing
 - Clear transient faults
 - Drive sufficient current to trip breakers
- Firm power source



Forming the grid

- Requires:
 - Synchronous generator (a.k.a. diesel generator)
 - Synchronous condenser
 - Voltage-source inverter
- Important because:
 - No grid, no power...
 - ... even if the sun is out, or the wind is blowing



Inertia

- Heavy spinning masses do not stop suddenly on disturbances (synchronous generator/condenser)
 - Can stabilize system and help ride through smaller issues
- Simulated inertia (inverters):
 - Adjust filtering circuits
 - Slow down reaction to disturbances (programming)



Spinning reserve capacity

- Requires:
 - Firm power source/sink
 - Energy storage system (boost power)
 - Demand management (reduce demand)
 - Best to combine
- Important, because:
 - Supply and demand have to match at any moment
 - Sudden drop in supply collapses the grid if not covered



Fault current/clearing

- Requires:
 - Capacity to overload equipment to either burn off transient faults, or trip circuit breakers
- If not available:
 - Hard to know fault location
 - Faults can hit back into sensitive equipment
- Alternatives:
 - Tripping breakers on under-voltage or under-frequency (requires smarter breakers and additional equipment)



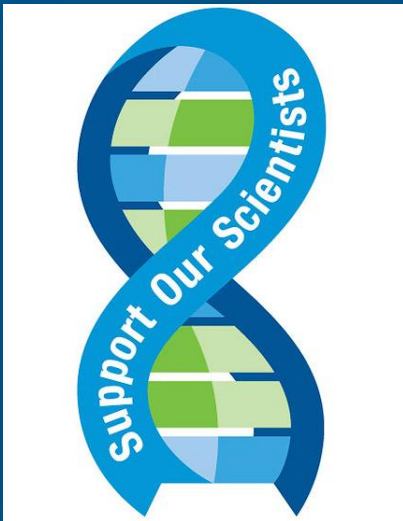
Diesel alternatives (non-fossil)

- Hydropower
- Voltage-source inverters with energy storage
- Synchronous condensers
- Supporting equipment:
 - Secondary load controllers
 - Demand management
 - Advanced controls
 - Advanced system protection



Thank you!

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