ENERNOC
An Enel Group Company

enel x

Enel Group today

Evolution and achievements since 2014[1]

enel x

#1 private **network** operator globally
65 mn end users and 44 mn digital meters

+4.5 mn end users
+8.4 mn smart meters[3]

□20 mn free **retail** customers
#1 in Italy, Iberia and top 3 in Latam

+5 mn free customers
+20% electricity sold in free market

#1 **renewable** operator
~40GW managed capacity[2]

+6 GW
+80%
additional capacity

□47 GW **thermal** capacity
Highly flexible and efficient assets

10 GW
capacity closure

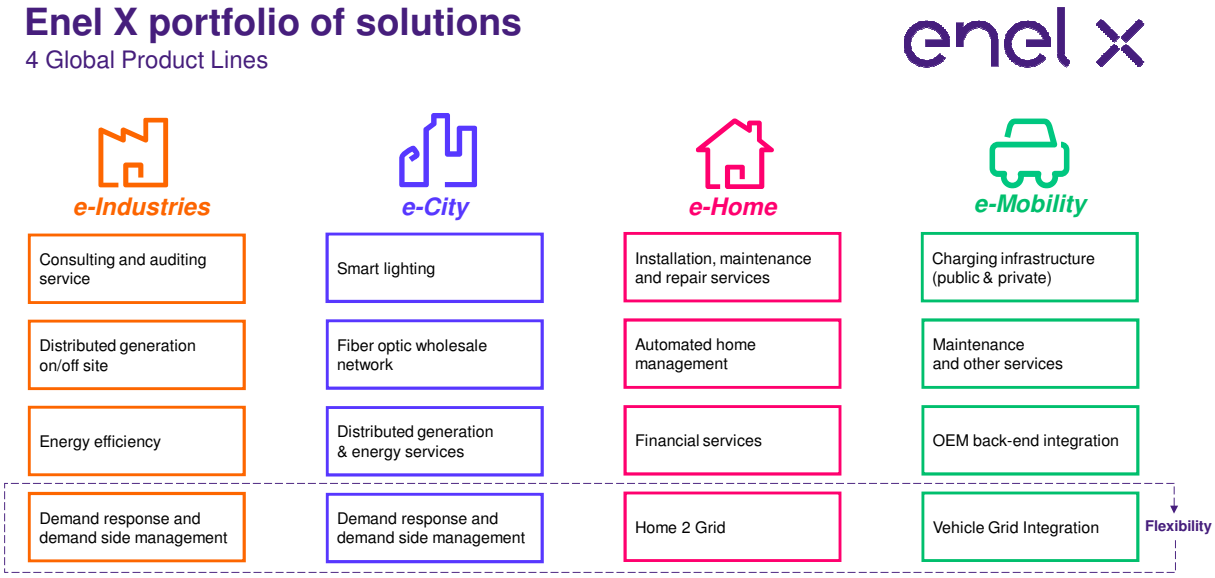
Enel X
~7 GW demand response

□ Countries of presence[4]

1. 2014-2017 delivery. As of 2017E
2. Including replacement of smart meters 2.0 in Italy. Enel global market share equal to 24% (BNEF 3Q17 Energy Smart technologies market Outlook)
3. Consolidated capacity equal to 37 GW (including 25 GW of large hydro)
4. Presence with operating assets

Enel X portfolio of solutions

4 Global Product Lines

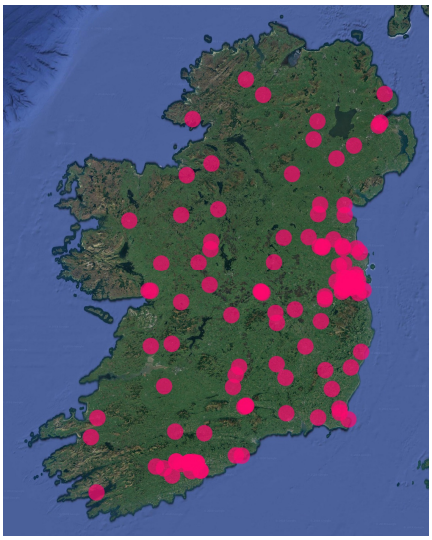


Addressing new customer needs with innovative technologies

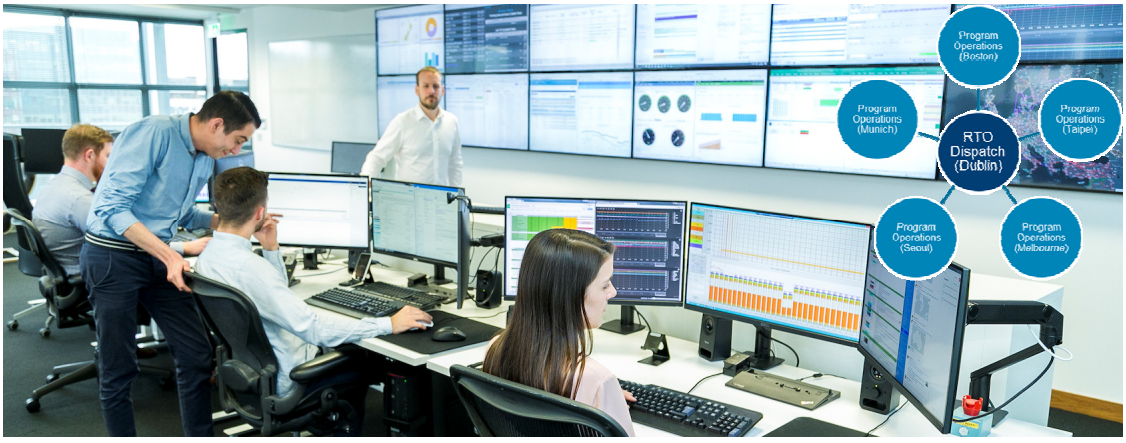
Demand Response in the I-SEM & DS3

Enel X in Ireland

- Active in Ireland since 2006
- First and largest aggregator
- Providing three different types of response:
  - Demand reduction
  - Demand increase
  - Frequency response
- 121 sites live today



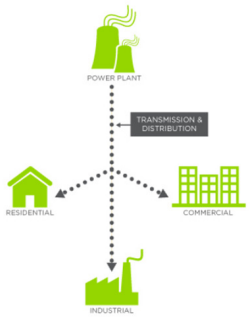
Dublin is our 24x7 global operations centre



Why do we need to be flexible?

The confluence of technical, economic and regulatory factors

TODAY: ONE-WAY POWER SYSTEM



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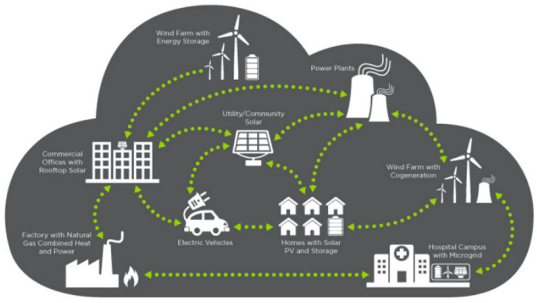
EMERGING: THE ENERGY CLOUD



(Source: Navigant Consulting)

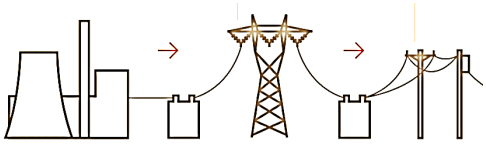
What exactly is being flexibile?

Grid operators seek these services to avoid building more infrastructure

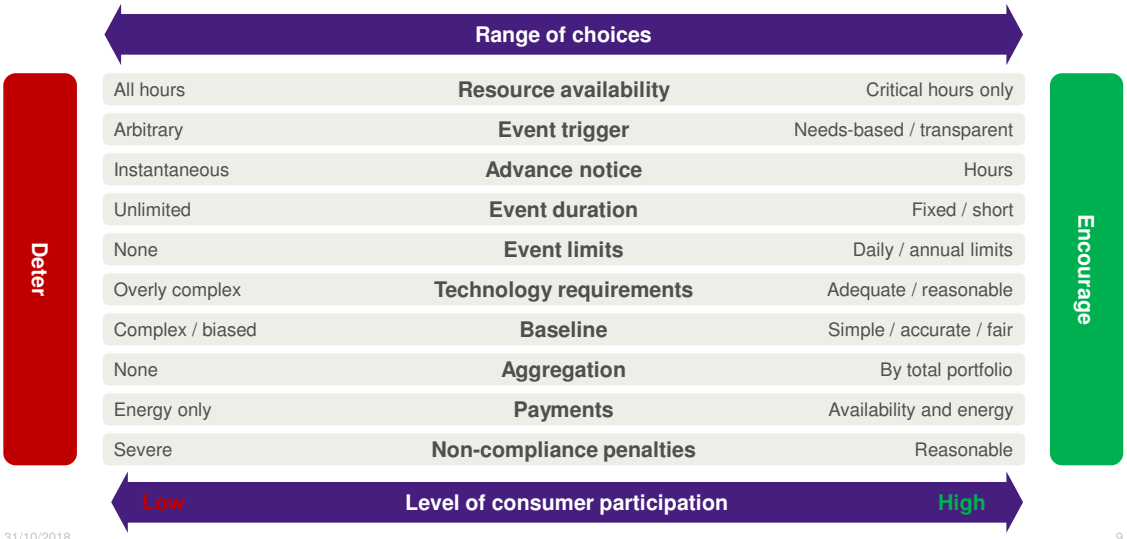
€€ Purchase Demand Response (DR)

OR

€€€ Build more power plants + network capacity



Attributes that affect participation



Overview: Flexibility Services

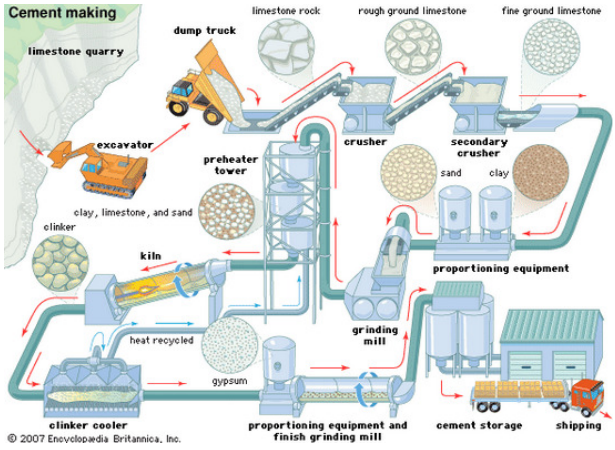
Global Market Information and Case Studies

Practical Examples:

- Cement Production
- Industrial Gases
- Chemical Processing
- Metal Manufacturing
- Datacentre
- Trainline

Overview of Cement Manufacturing

Energy Reduction Strategies



Primary Strategies

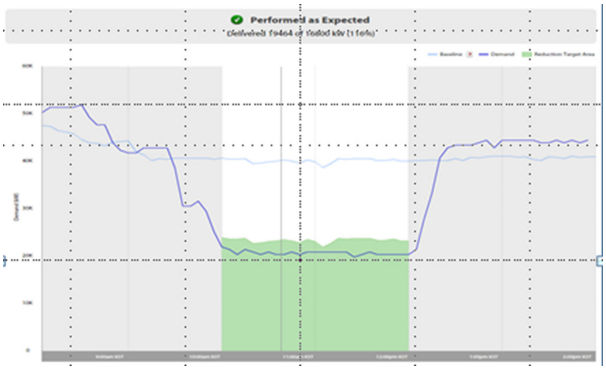
- Stop primary and secondary crushers
- Stop proportioning / grinding mill / cement mill
- Stop finishing mill
- Some plants will shut down clinkers (uncommon)
- Kilns and heat operations are maintained in most cases

Considerations

- Use of process storage
- Seasonality in process
- Batch process
- Benefits of aggregation

Cement Manufacturer — UK

Capacity Market & Ancillary Services Market Enrolment



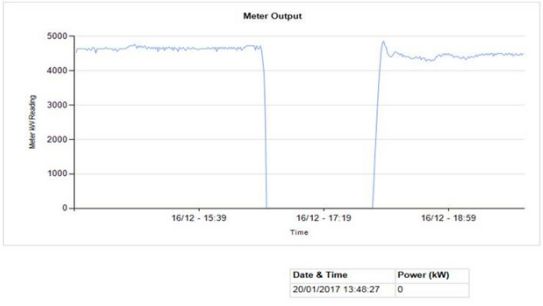
Load reduction of between 14 MW and 17 MW

Energy Reduction Plan:

- Plant can sustain drop for over 5 hours
- Strategy includes stopping raw mills and cement mills for 1 to 2 hours at a time
- Shut downs are staggered to ensure production throughput is maintained for some of the plant
- Total annual revenue for DSR was ~900,000 GBP equivalent

Industrial Gas Application — Ireland

Load reduction at a nitrogen production plant



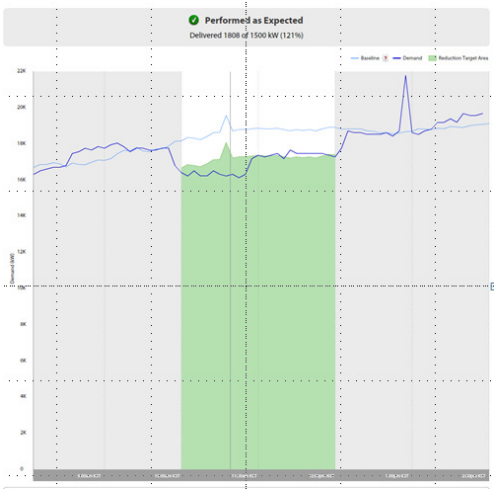
Energy Reduction Plan:

- Full shut down of air separation units and associated pumps
- Total load reduction of ~5 MW for event

- Plant makes cost benefit calculation
- Factors include:
  - Number of expected dispatch events per year
  - Expected duration of events
  - Avoided electricity costs during events
  - DSR payments
  - Payment reduction schemes for non-performance
  - Cost of electricity during restart
- Plant calculates cost per MWh of reduction on an event by event basis to determine level of participation

Hydrogen Peroxide Plant — USA

Volatile process, engineers on-site determined plan



- Total load reduction of ~1,500 kW
- Energy Reduction Plan:
  - Slow down pumps feeding input process

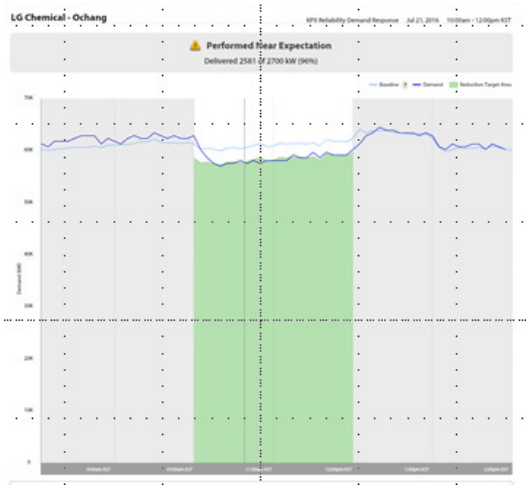
    P-1301, P-1309S, P-2209S, P-7601A (total of 550 kW)
  - Stop one of 5 compressors (450 kW)

    C-5551
  - Stop or slow down aeration fans (400 kW)

    OC CT Fan-1, OC CT Fan-2, OC CT Fan-3, OC CT Fan-4, OC CT Fan-5
- Plant can sustain reduction for over 8 hours

Battery Manufacturing — South Korea

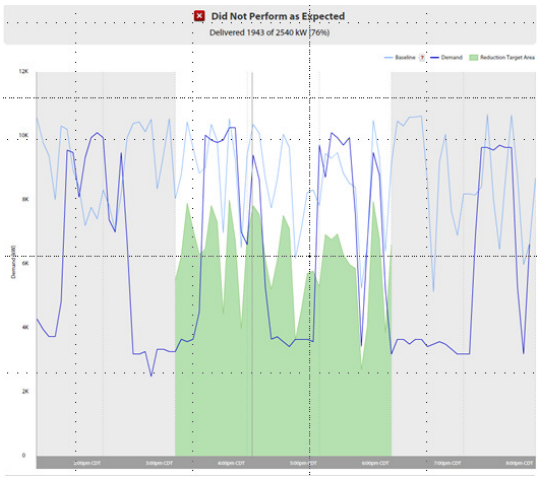
Combination of load reduction and generation



- Total load reduction of ~2.6 MW
- Combination of load reduction from supporting processes and behind the meter generation
- Energy Reduction Plan:
  - Shut down air conditioning in plant (125 kW)
  - Reduce shrinkage heat in process (300 kW)
  - Stop polarizer coating process (600 kW)
  - Turn on backup generator (1,575 kW)

Metal Manufacturing — USA

Executing on a challenging Energy Reduction Plan



Energy Reduction Plan

- Shut down Melting and Holding Furnaces
- Shut down Blast and Polishing Machines
- Shut down Seasoning / Finishing lines after product completed
- Shut down air compressors as appropriate

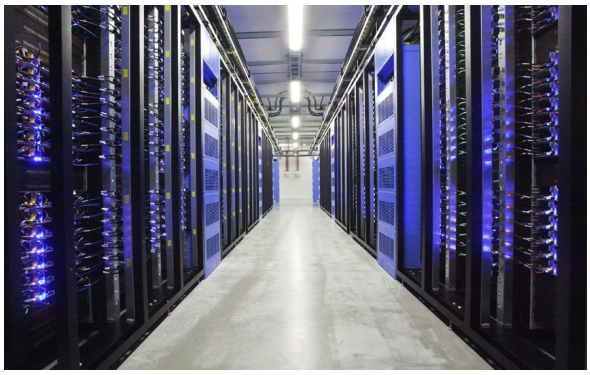
Operational Challenges:

- For this event, customer was unable to maintain reduction for entire event due to customer orders
- EnerNOC worked with them in real time to cycle necessary equipment to deliver 76% performance while allowing customer orders to be processed
- Company received majority of expected payments

Data Centre — Ireland

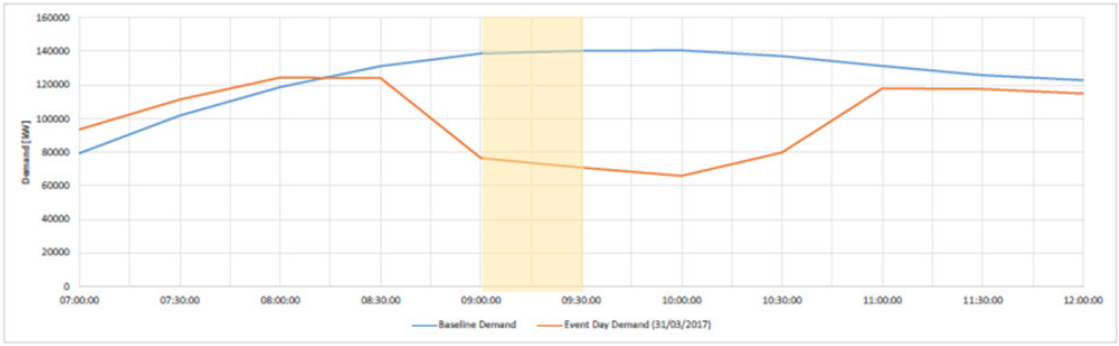
Demand response provides many benefits, including improved resilience

Rather than always testing the generators on a scheduled basis, the site is able to fortify its infrastructure and operations by carrying out generator runs outside the normal scheduled test time window. Fortunately, the team was already implementing an extremely rigorous on-load testing regime. “Moving a percentage of your load to generation is absolutely necessary, and if you can sell your generative capacity then that is an added bonus.”



Underground Transportation System — UK

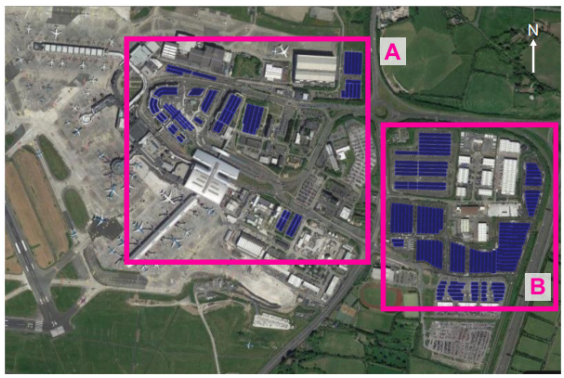
Using backup generation to help stabilise the grid



The future of flexibility: Energy as a Service

Dublin Airport

1. Providing frequency response and capacity
2. Supporting airport to explore operational savings potential through microgrid deployment



Microgrid: Energy as a Service — USA

Marcus Garvey: Fuel Cell + Solar + Storage

Load Profile:	~1.7MW Peak	
Configuration:	Storage	1.5 MW
	Solar	400kW
	Fuel Cell	400kW
Applications:	Multi-DER Aggregation	
	Critical Load Backup Power	
	Arbitrage	
	Demand Charge Reduction	
	Export Control & Optimisation	

Energy as a Service — Italy

Conad: Italy: 320 EV Charging Stations

Objective: Innovative service (add value)

Hardware: 280 Quick Charge (22kW)
40 Fast Charge (50kW) (EVA +)

Benefits: Increase catchment
First to market
40 Fast Charge units free

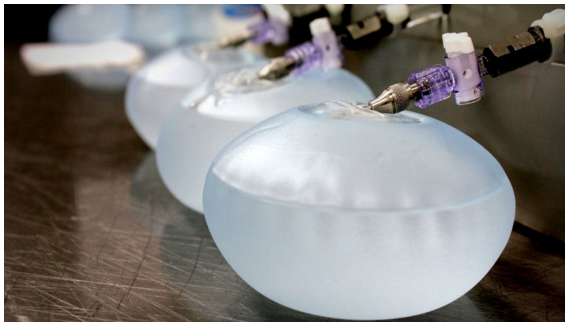
Microgrid: Energy as a Service — Costa Rica

Establishment Labs: Fuel Cell + Solar + Storage

Load Profile: ~1.4MW Peak

Configuration: Storage 1.0 MW
Solar 270 kW

Applications: Multi-DER Aggregation
Critical Load Backup Power
Arbitrage
Demand Charge Reduction

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25