Data centres in Ireland

SCENARIO ANALYSIS FOR ETSAP WORKSHOP

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Data centres overview

Physical facilities that companies use to host their critical applications and data. Demand increased rapidly in recent years and will further increase stimulated by new data-intensive technologies such as artificial intelligence, machine learning.

Why is it relevant for the energy system?

Electricity consumption for:
- IT equipment (servers, storage, transmission)
- Cooling system
- Others

Hyperscale DCs can have a demand capacity >100 MW

But... waste heat recovery is possible!

Why is it relevant for Ireland?

Factors that make it perfect for hosting DCs:
- Weather conditions
- Good fibre connections with US
- Attractive corporation tax

Factors that make DCs hard to handle:
- Big growth expected in the next decade
- Concentration in Dublin area
- Isolated energy system (lack of grid connections with other countries)
- Decarbonization targets
Ireland decarbonization pathways

“Climate Action & Low Carbon Development (Amendment) Act 2021” targets to reduce greenhouse-gases [GHGs] by:

- 51% by 2030,
- net-zero by 2050.

A33E61:
- 33% reductions from agriculture,
- 61% reductions from energy & industry by 2030

More mitigation scenarios developed by the MaREI Energy Policy and Modelling Group available:

https://tim-carbon-budgets-2021.netlify.app/scenarios
https://zenodo.org/record/5517363#.YZ-uVtDP02w

ETSAP workshop, 30.11.’21
DCs in TIM

ETSAP workshop, 30.11.’21

From power sector

SRVELC (IT elc)
SRVELC-DC-C (cooling elc)

S-DCE-CS (DC process)

SRVDCE-CS (Demand)

S-DCE-CS-HE_N1 (heat exchanger)

S-DCE-CS-HP_N1 (heat pump)

HET-GRID (DH network)

Season Weekly DayNite
Wi NW A (0-7)
Sp WD B (7-9)
Su C (9-17)
Au D (17-19)
E (19-0)

40 time-slices
DCs in TIM

Cooling system electricity and waste heat are expressed as share of the total consumption of the process.

Shares are taken from a thermodynamic model on hourly level, then aggregated on time-slices level in TIM.
1_Flat: Flat demand

**Capacity:** 1100 MW (already connected)
Eirgrid, All-Island-Generation-Capacity-Statement-2020-2029

**Load factor:** 40%
Eirgrid, All-Island-Generation-Capacity-Statement-2020-2029
Demand projections

**2_LF**: load factor increase

**Capacity**: 1100 MVA
(already connected)

**Load factor**: grows linearly from 40% up to 70% in 2030

Eirgrid expects the load factor to rise as customers build out to their full potential.

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Demand projections

3_cap: All current applications approved

Capacity:
- 1800 MVA in 2022
  (connection agreements already in place)
- +2000 MVA up to 2030
  (additional requests already received)

CRU21060-CRU-consultation-on-Data-Centre-measures

Load factor: 40%
**Demand projections**

**4_LFcap**: All current applications approved and load factor increase

**Capacity:**
- 1800 MVA in 2022 (connection agreements already in place)
- +2000 MVA up to 2030 (additional requests already received)

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**Load factor**: grows linearly from 40% up to 70% in 2030

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DCs elc vs total elc demand

Scenarios recap

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<thead>
<tr>
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<th>Capacity [MVA]</th>
<th>Load factor [%]</th>
<th>Demand [PJ]</th>
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<tr>
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<td>E61-4_LFCap</td>
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DCs electricity vs total electricity

DCs electricity as share of total electricity
New capacity installed

- Investments in gas power plants in 2024 due to coal phase out in 2025
- Each year a considerable level of new wind off-shore capacity
- Some investment in CCS technologies in 2030
New capacity installed (Up to 2030)

- In the next 8 years the system will need from **16 to 17.8 GW of new capacity** to meet decarbonization targets.
- This 1.8 GW difference is covered mostly from **wind off-shore**.
- But... in the case of very high demand the further difference is covered by **new gas power plants**.
From 2027, in 3° and 4° demand scenarios, new investments in DH networks are no longer cost optimal. While the potential grows the share of heat actually used decreases.
What if no heat recovery?

- The heat recovered from DCs is used for space and water heating in service and residential sectors.
- Heat is replaced mostly by gas and to a small extent by oil. In the 4th case there’s also a big contribution of biomass.
- The amount of gas avoided by recovering the waste heat is lower than the amount of additional gas required in the power sector due to DCs growth (18.09 PJ vs 53.90 PJ in the 4th case).
Emissions by sector

Emissions from the **power sector** increase as the demand from DCs grows

more pressure on the other sectors to speed up the transition

- What happens in 2029 to the industrial sector?
- What happens in 2030 to the residential sector?

New investments in greener technologies?

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CO2 Price

CO2_price = 2 kEur/ton

No cheaper options to mitigate emissions than Direct Air Capture «backstop» technology used to make the scenario feasible

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Discussions

Assumptions / input data:

• Cooling system
• Waste heat
• Load factor increase

Analysis:

• Impact to other sectors
• Comparison with less challenging scenarios

Lack of reliable data:
Literature review and sensitivity analysis

New ideas are welcome
THANK YOU FOR LISTENING

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