The potential to harness demand-side flexibilities from large-scale wastewater treatment plants in an integrated energy system

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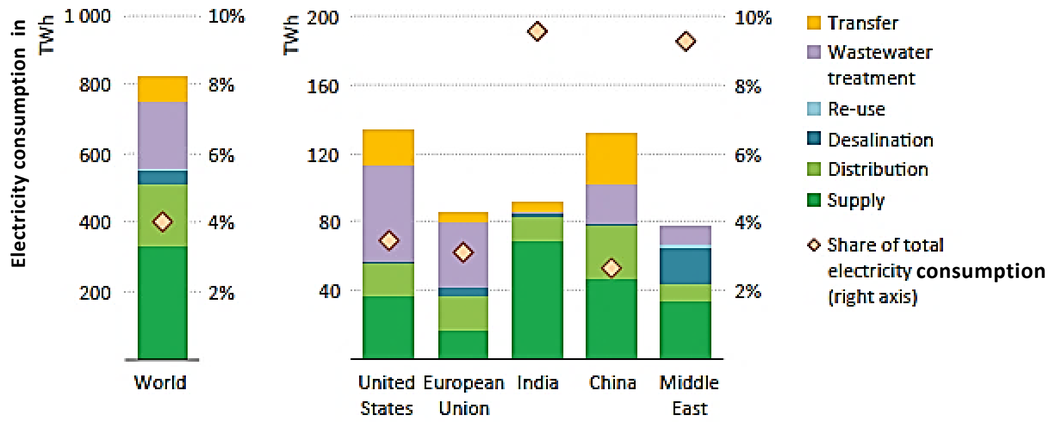
Background



Electricity consumption in the water sector by process and region in 2014; Source: IEA (2016).

- In developed countries, ***42%*** of water-related electricity consumption is used for wastewater treatment.
- Globally, wastewater treatment consumes about 200 TWh of energy.

Flexible operation of wastewater treatment plants can provide a tool to introduce more demand-side flexibility to the energy system.

Research question

Effects of flexibility?
- Lower wastewater treatment costs?
- Lower energy system costs?

Current incentives?
- Financial incentives
- Behavioural analysis

Potential corrections?
- Policy instruments

Identification and quantification of flexibility potential as prerequisite

Approach

Continuous cooperation within ESIPP

Input from Engineering → Step 1 → Step 2 → Step 3

Evaluation of flexibility potential	Flexible Wastewater Treatment Plant Operation	Integration into electricity system	Extension of the energy system model

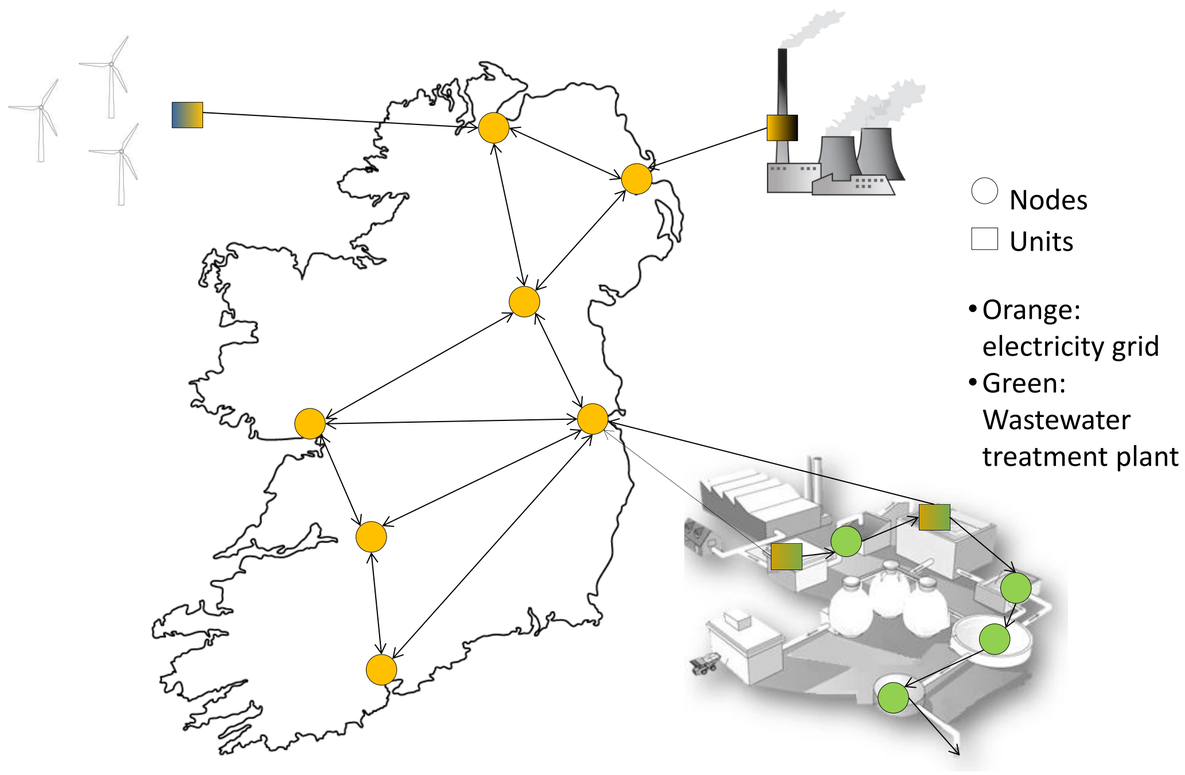
Unit Modelling
Consideration of biological, biochemical and chemical processes

System Modelling
Focus on energy and water flows

Methodology

Backbone: generic energy system optimization tool written in GAMS.

- Adaptable
- Short-term forecasts and longer-term statistical uncertainties
- Data driven



Contribution

Deeper understanding of the wastewater aspect of the energy-water nexus

- **Insights**
- **Input**
  - Integration in wider energy models
  - Cooperation within ESIPP
- **Implications**
  - For Policy makers
  - For wastewater treatment plant operators

Outlook

- Further work on Backbone
- Data for Ireland
- Wastewater treatment plant operation profiles according to different flexibility options
- Quantification of system benefits
- Potential extensions of the model
  - Modelling the water grid to extend storage possibilities
  - On-site biogas production
  - Policy interventions

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