Data-driven Non linear Prediction Model for Price Signals in Demand Response Programs

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Outline

- Motivations
- Engaging the flexible resources
- Role of demand response
- Neural network
- Results
- Conclusions
Denmark’s ambitious climate target

- **70%** GHG reduction by 2030
- **At least 55%** RE-share in total energy consumption by 2030
- **100%** Green electricity by 2030
- “Low-emission society” in 2050 Independence from fossil fuels
Balance in power systems
Balance in power systems
Engaging the flexible resources
Engaging the flexible resources
Engaging the flexible resources
Engaging the flexible resources
Engaging the flexible resources
Leveraging demand response

It consists of **changes in consumers’ electricity demand** that provide services to the grid.
Indirect control approach

Operator
(utility)

Electricity consumers
Indirect control approach

Operator (utility)

Electricity consumers

Control logic

Motivations

Flexibility

Demand response

Neural network

Results

Conclusions
Indirect control approach

Operator (utility)

Dynamic electricity price

Electricity consumers
Indirect control approach

Motivations

Flexibility

Demand response

Neural network

Results

Conclusions

Operator (utility)

Electricity consumers

Aggregate reaction

Consumption

Time

Motivations

Flexibility

Demand response

Neural network

Results

Conclusions

Neural network

Demand response

Operator (utility)

Electricity consumers

Aggregate reaction

Consumption

Time
Indirect control approach

Motivations

Flexibility

Demand response

Neural network

Results

Conclusions

Operator (utility)

Electricity consumers

Lower electricity prices

Neural network

Results

Demand response

Neural network

Results

Conclusions

Control logic

Motivations

Flexibility

Demand response
Formulating the dynamic electricity price

To predict the electricity price to submit to the pool of consumers*

* having certain information about the pool of consumers
Neural network

Input

Neural network

Output
Case study of Lærkevej
Results

R value: 90%
MSE: 0.009
Conclusions

**Demand response** can unlock flexibility to support the Danish ambitious climate targets.

**Dynamic electricity prices** can be used in demand response programs.

**Neural network** can help to formulate dynamic electricity prices to achieve aggregate change in consumption.
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