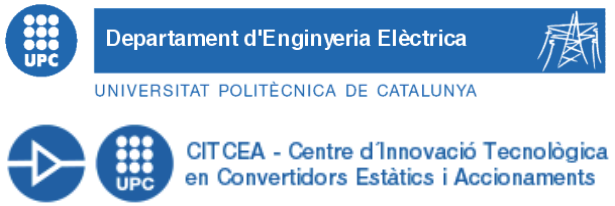
Universitat Politècnica de Catalunya

Departament d'Enginyeria Elèctrica



Doctoral Thesis

Aggregated flexibility services for distribution network operation

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"Oh how much is left to learn"

Ziggy Alberts

"Always remember the blue sky.
Let thoughts come and go"

"Pas a pas"

To Sílvia,
Joan and Jèssica.

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- EIT InnoEnergy PhD School.
- Danish Tehcnical University (DTU), Denmark.

Abstract

Resum

ABSTRACT AJFLKJRLRNFLEMFREF

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RESEARCH QUESTION: INCLOURE FEINA DEL PAPER DEL CIRED

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- pilot estabanell INVADE - BD4OPEM
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incloure aqui diagrama interaccio de l INVADE-CIRED Possibilitat d incloure els use cases que estem fent pel BD4OPEM

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RESEARCH QUESTION: Feina que estic fent a DTU

4.1.1 Use cases/Business models for flexibility services and flexibility forecast

4.1.2 Literature review on flexibility forecast

4.1.3 Contribution

- non-intrusive approach
- less data required (15 kHz for NILM algorithms). Here we can work with 1 minute data
- no submetering (only main smart meter data)
- total aggregated load forecast
- from the total load forecast, we forecast the flexibility UP and flex DOWN, as well as the INFLEXIBLE load
- flexible capacity band (power band) forecast

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- combinatorial optimization
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Appendix A

Publications

Included in the thesis

Published journal papers

J2 P. Olivella-Rosell, P. Lloret-Gallego, Í. Munné-Collado, R. Villafafila-Robles, A. Sumper, S. Ottesen, J. Rajasekharan, B. Bremdal, "Local flexibility market design for aggregators providing multiple flexibility services at distribution network Level," *Energies*, vol. 11, no. 4, p. 822, Apr. 2018. doi: 10.3390/en11040822

Submitted journal papers

J4 flexibility review hussain

Conference papers

C1 I. Munné-Collado, P. Lloret-Gallego, P. Olivella-Rosell, R. Villafafila-Robles, S. Ø. Ottesen, R. Gallart-Fernandez, V. Palma-Costa, A. Sumper, "System architecture for managing congestions in distributions grids using flexibility," 25th International Conference on Electricity Distribution, June 2019.

- conference sara LCA

Book chapters

BC1 Í. Munné-Collado, P. Olivella-Rosell, A. Sumper, "Power Market Fundamentals," in A. Sumper (ed) Micro and Local Power Markets, John Wiley & Sons, pp. 1-35, 2019. doi: 10.1002/9781119434573.ch1

BC2 Í. Munné-Collado, E. Bullich-Massagué, M. Aragüés-Peñalba, P. Olivella-Rosell "Local and Micro Power Markets," in A. Sumper (ed) Micro and

Local Power Markets, John Wiley & Sons, pp. 37-97, 2019. doi: 10.1002/9781119434573.ch2

Not included in the thesis

Published journal papers

J3 Í. Munné-Collado, F. M. Aprà, P. Olivella-Rosell, R. Villafafila-Robles, A. Sumper, "The potential role of flexibility during peak hours on greenhouse gas emissions: a life cycle assessment of five targeted national electricity grid mixes," *Energies*, vol. 12, no. 23, Nov. 2019. doi: 10.3390/en12234443

J4 review sara big data

J5 review hussain

Submitted journal papers

Conference papers

- kejrwejr

Local conferences

Published papers

Conference presentations

Supervised bachelor and master thesis

T1 F. Aprà, "Environomical analysis of peak hours electricity production in targeted European countries", June 2019.

T2 K.,Beehuspoteea, "Impact factors of heat generation units for zoned temperature controlled in office buildings", June 2019.

T3 A. Quattrone, "Development of flexibility device models for a microgrid laboratory test", June 2019.

T4 N. Condorelli, "Evaluation and forecast of CO2 emissions in the electricity sector for European targeted countries" March 2020.

T5 P. Plana, "Analysis of measures to increment the share of renewable energy in distribution grids" April 2020.

T6 A. Bové Salat, "Optimal scheduling of flexible assets under a HEMS for prosumers' economic savings" June 2020.

T7 M. Ferran, "Power flow tool for active distribution grids and flexibility analysis", June 2020.

Published technical reports

TR7 E. F. Bødal, P. Crespo-del-Granado, H. Farahmand, M. Korpås, P. Olivella-Rosell, I. Munné-Collado, P. Lloret-Gallego, "INVADE Deliverable 5.1 Challenges in distribution grid with high penetration of renewables," June 2017. doi: 10.5281/zenodo.853271

- entregables INVADE LCA?
- entregables EMPOWER LCA?