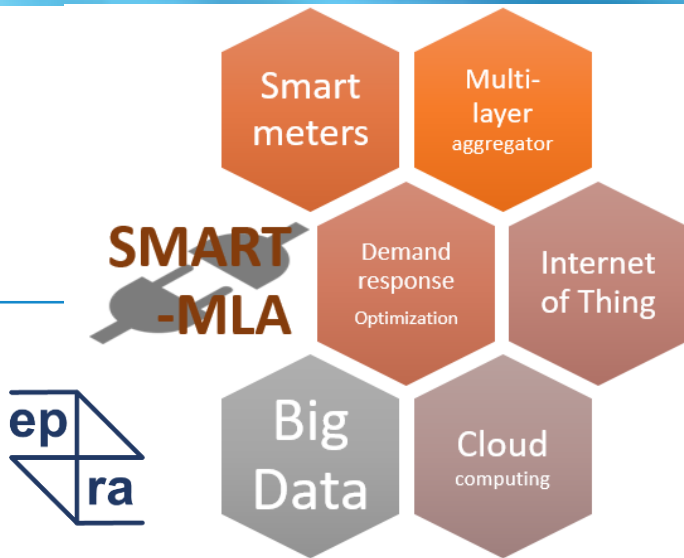


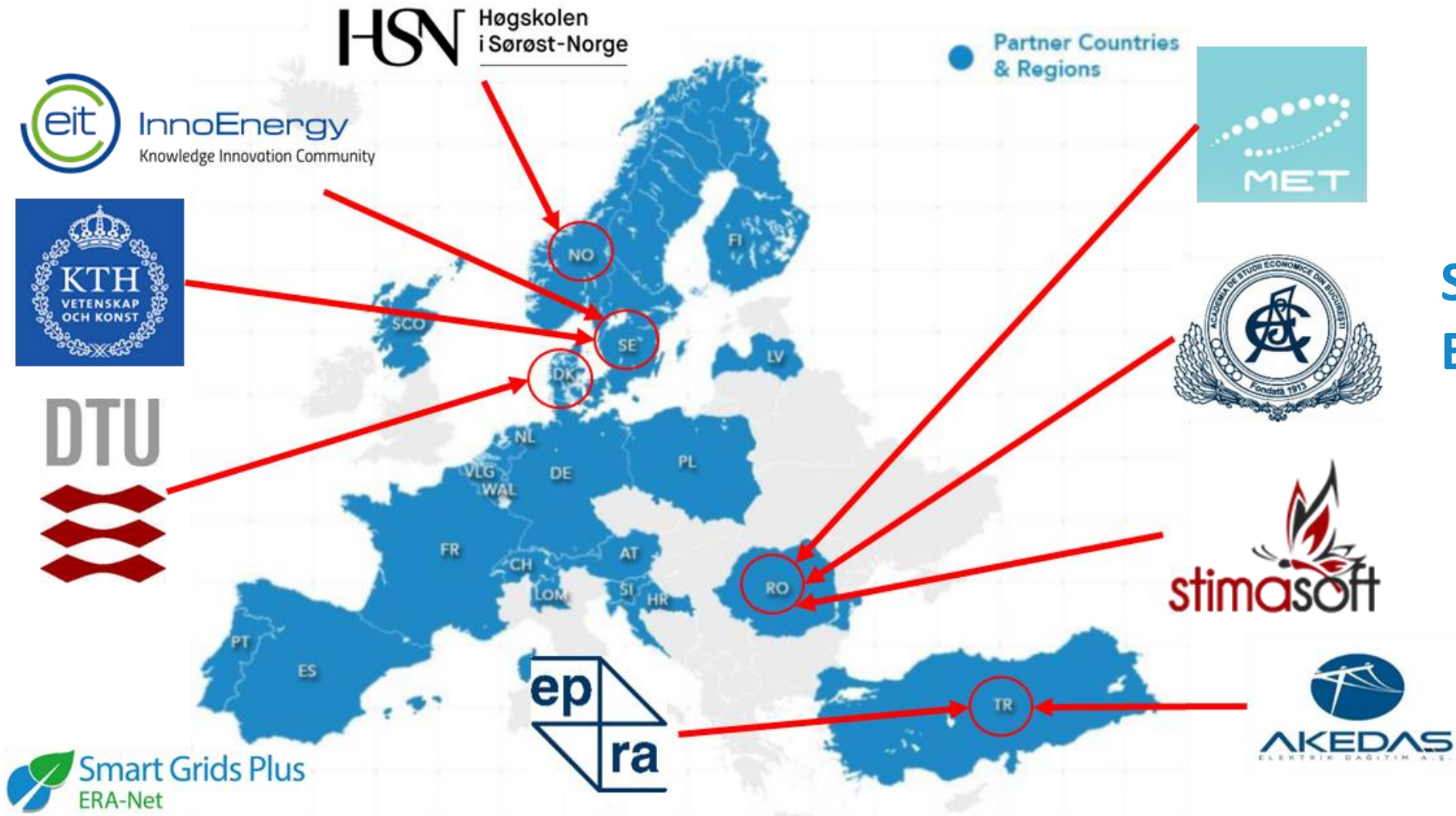
## MULTI-LAYER AGGREGATOR SOLUTIONS TO FACILITATE OPTIMUM DEMAND RESPONSE AND GRID FLEXIBILITY (SMART-MLA)

**Aggregator, Demand Response, Flexibility**

<http://smart-mla.stimasoft.com>



# Project Partners



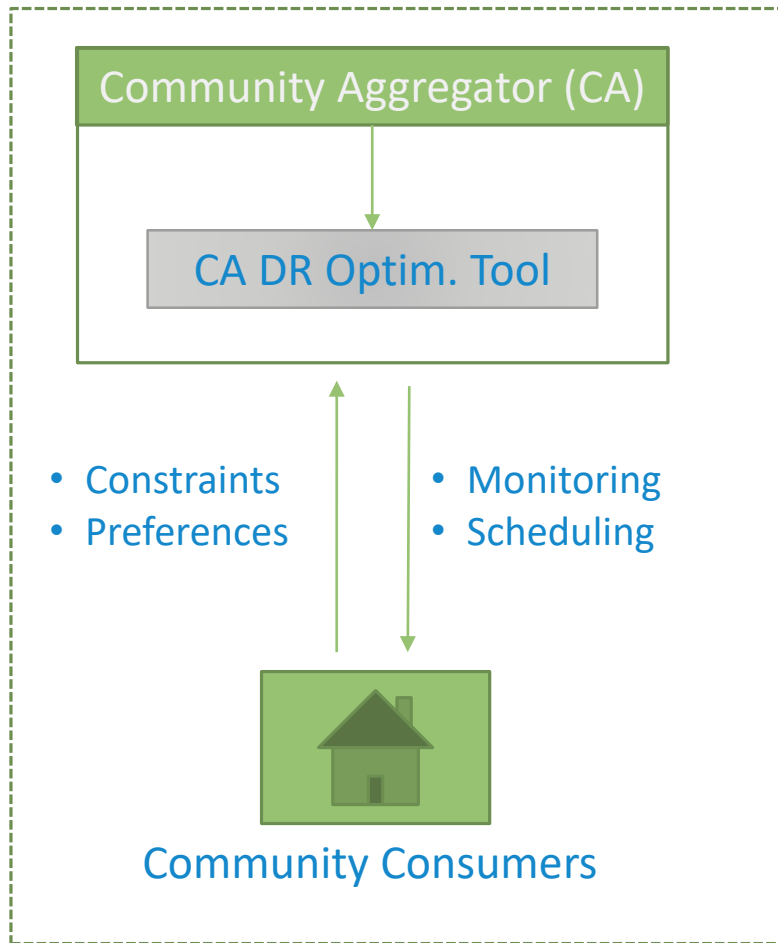
**Start: Nov. 2018**  
**End : Oct. 2021**  
**(3 years)**

Layer 3: Aggregation in Wholesale Electricity Markets – AWEM  
(Monitor / Optimize / Control / Bidding / Market Clearing / Settlement)

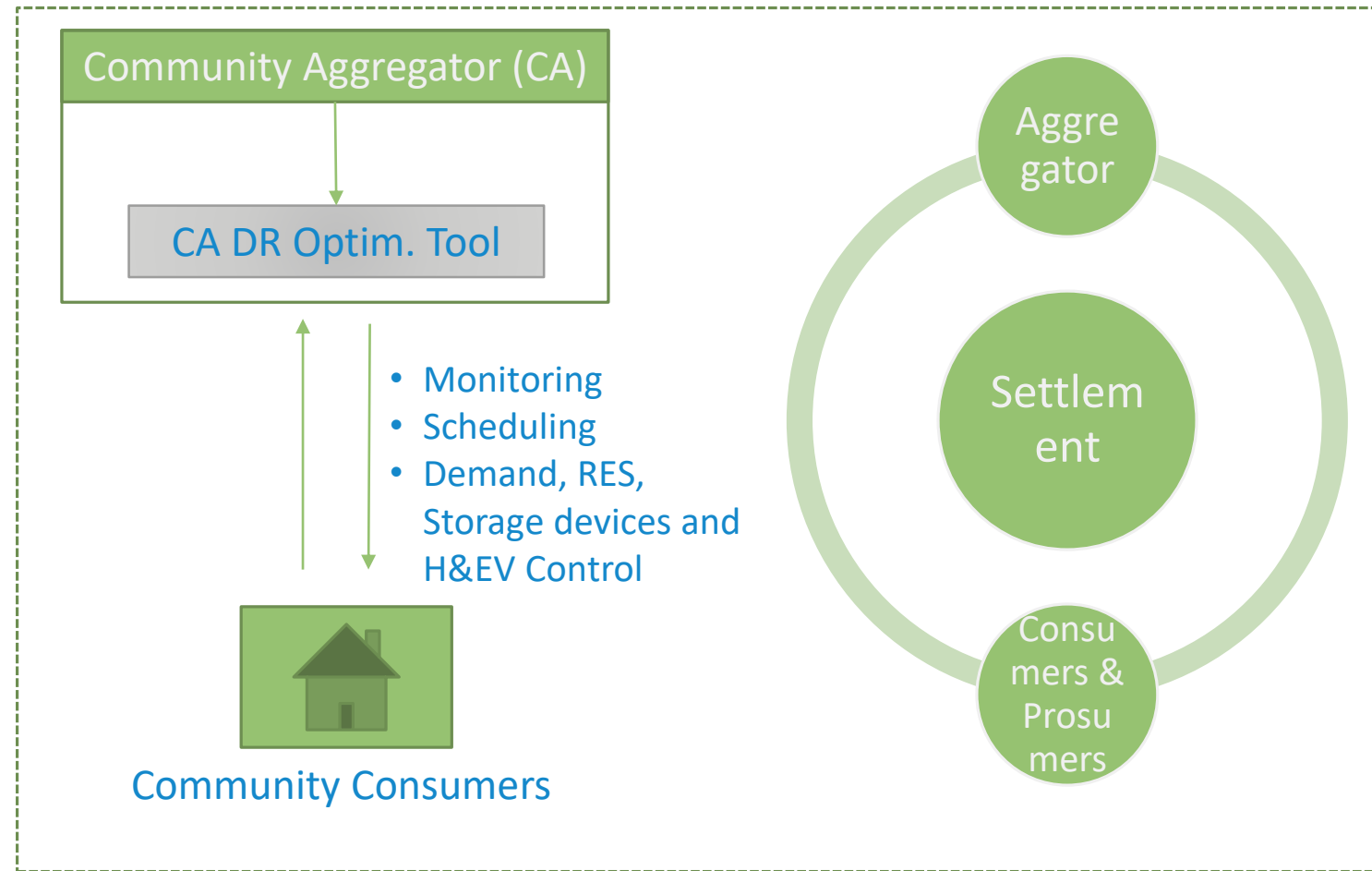
Layer 2: Community Aggregator with Control  
(Monitor / Optimize / Control / Settlement)

Layer 1: Community Aggregator  
(DR Optimization only / No Control)

# Concept (cont.)

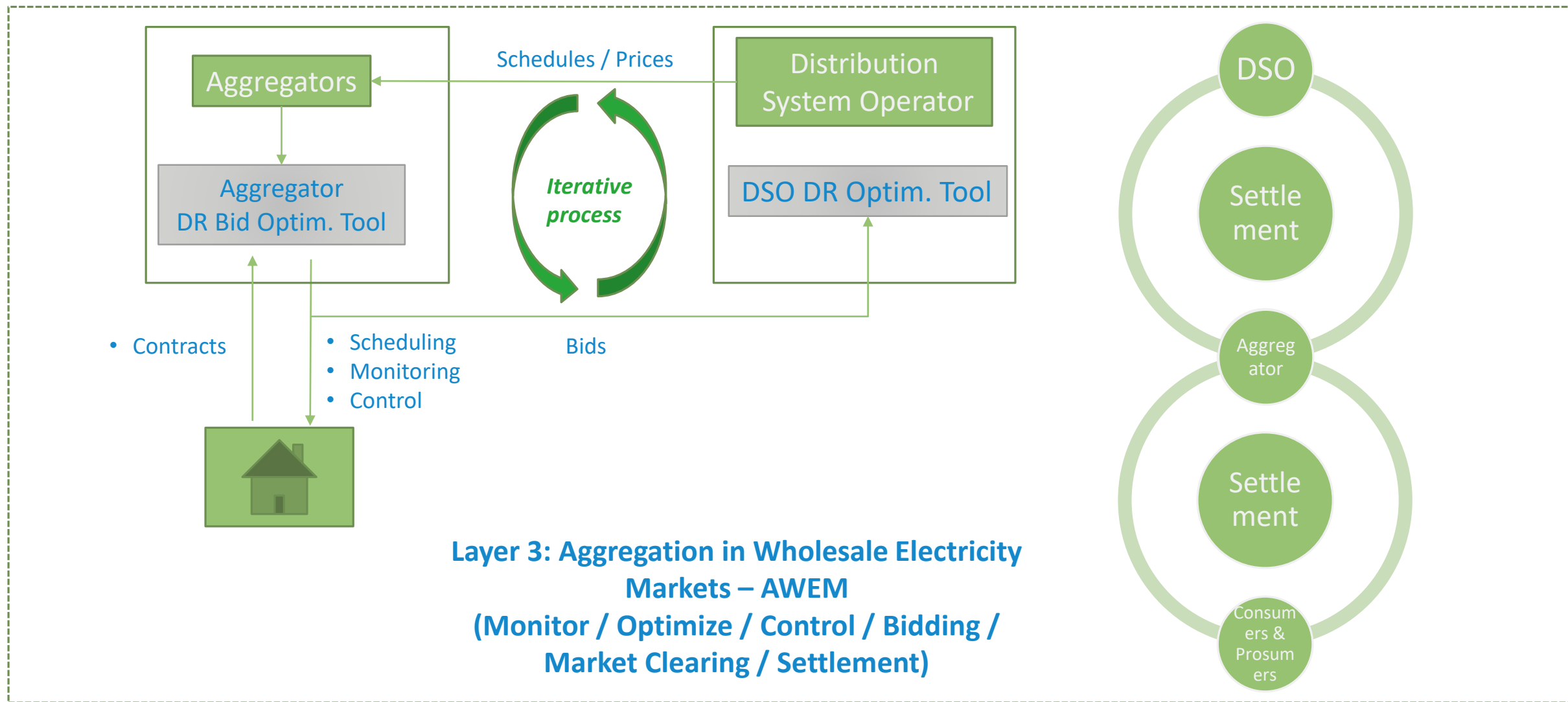


**Layer 1: Community Aggregator (DR Optimization only / No Control)**



**Layer 2: Community Aggregator with Control (Monitor / Optimize / Control / Settlement)**

# Concept (cont.)



# Project Outline: Results, Status and Impact

Layer	Result(s)	Level	Progress	Advances and Challenges
Technology	<ul style="list-style-type: none"> <li>Optimization algorithms                             <ul style="list-style-type: none"> <li>❖ Layer 1, 2, and 3</li> </ul> </li> </ul>	TRL 4-5	L1: 80%; L2: 40% L3: 40%	<ul style="list-style-type: none"> <li>L1: First trial run satisfactorily</li> <li>Smart contract (block-chain) mechanisms are complex at household level</li> <li>Market mechanisms including aggregators at DSO level have not developed yet (EU context)</li> <li>Legislative requirements for market mechanisms and roles of aggregators</li> </ul>
	<ul style="list-style-type: none"> <li>Forecasting algorithms                             <ul style="list-style-type: none"> <li>❖ Demand, renewable generation</li> </ul> </li> </ul>	TRL 4-5	50%	
	<ul style="list-style-type: none"> <li>Cloud-based web-service application tool</li> </ul>	TRL 4-5	30%	
Market	<ul style="list-style-type: none"> <li>Settlement mechanisms design and development</li> </ul>	TRL 4-5	20%	
	<ul style="list-style-type: none"> <li>Business model development</li> </ul>	TRL 4-5	5%	
Adoption	<ul style="list-style-type: none"> <li>Integration of optimization tools with Cloud-based web-service application tool (Prototype)                             <ul style="list-style-type: none"> <li>❖ Layer 1, 2, and 3</li> </ul> </li> </ul>	TRL 5-7	Not started	
<b>Level</b>	<b>TRL 3-4: Research   TRL 4-5: Development   TRL 5-7: Demonstration</b>			

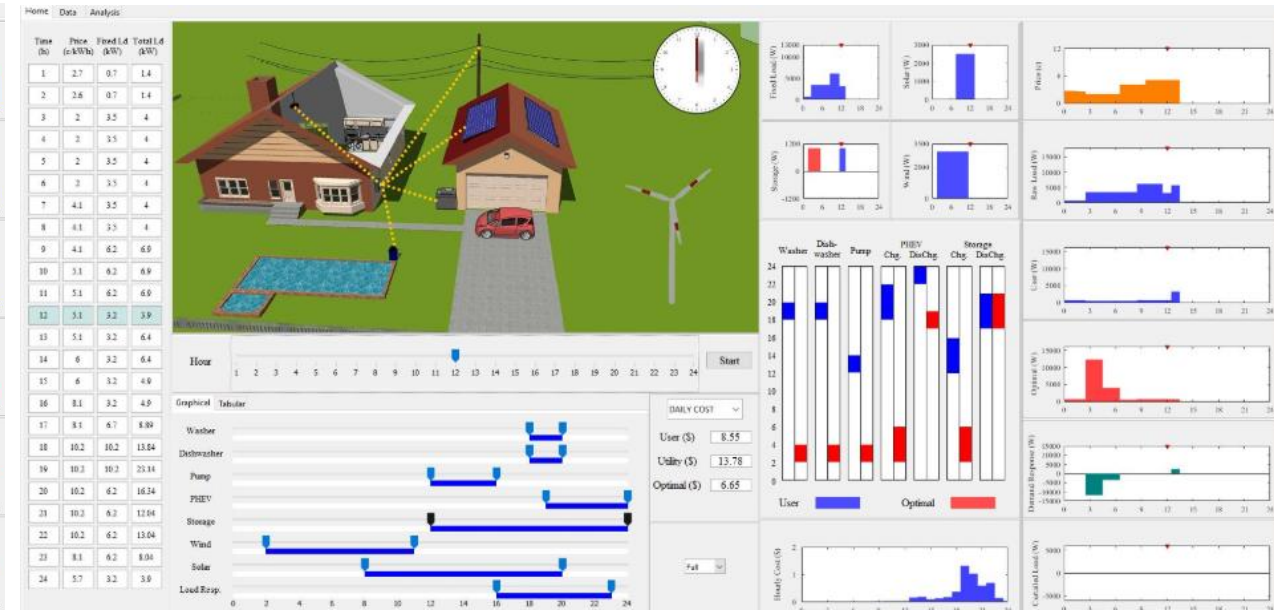
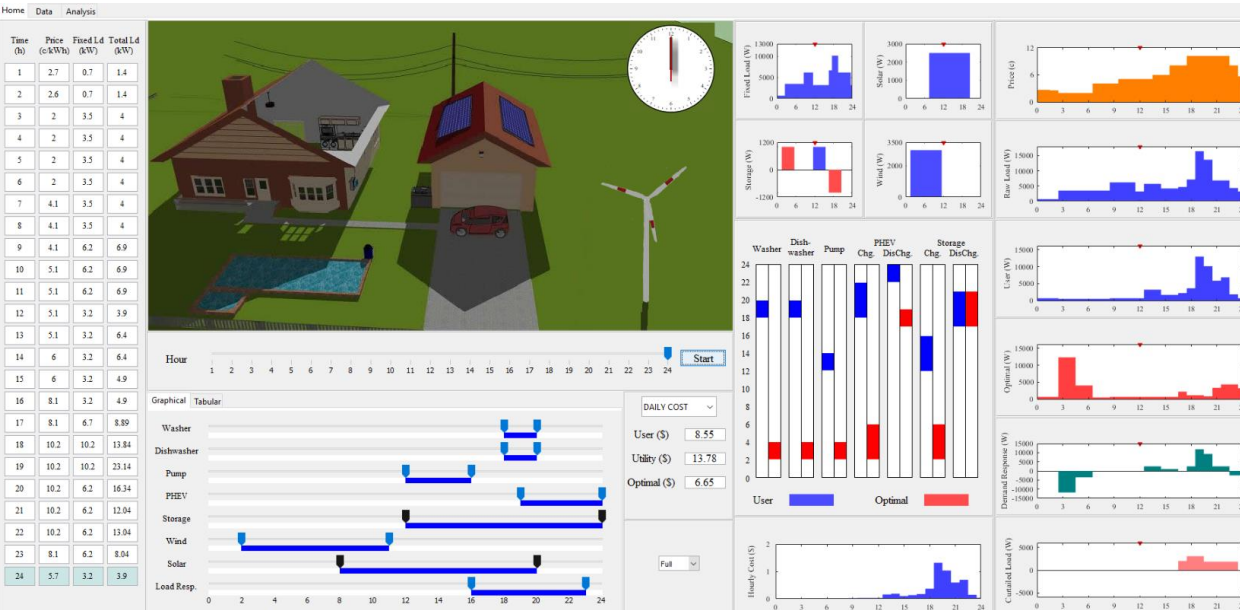


# Most Valuable Insight Gained in the Project regarding the WG topic



## Layer 1 (Community Aggregator)

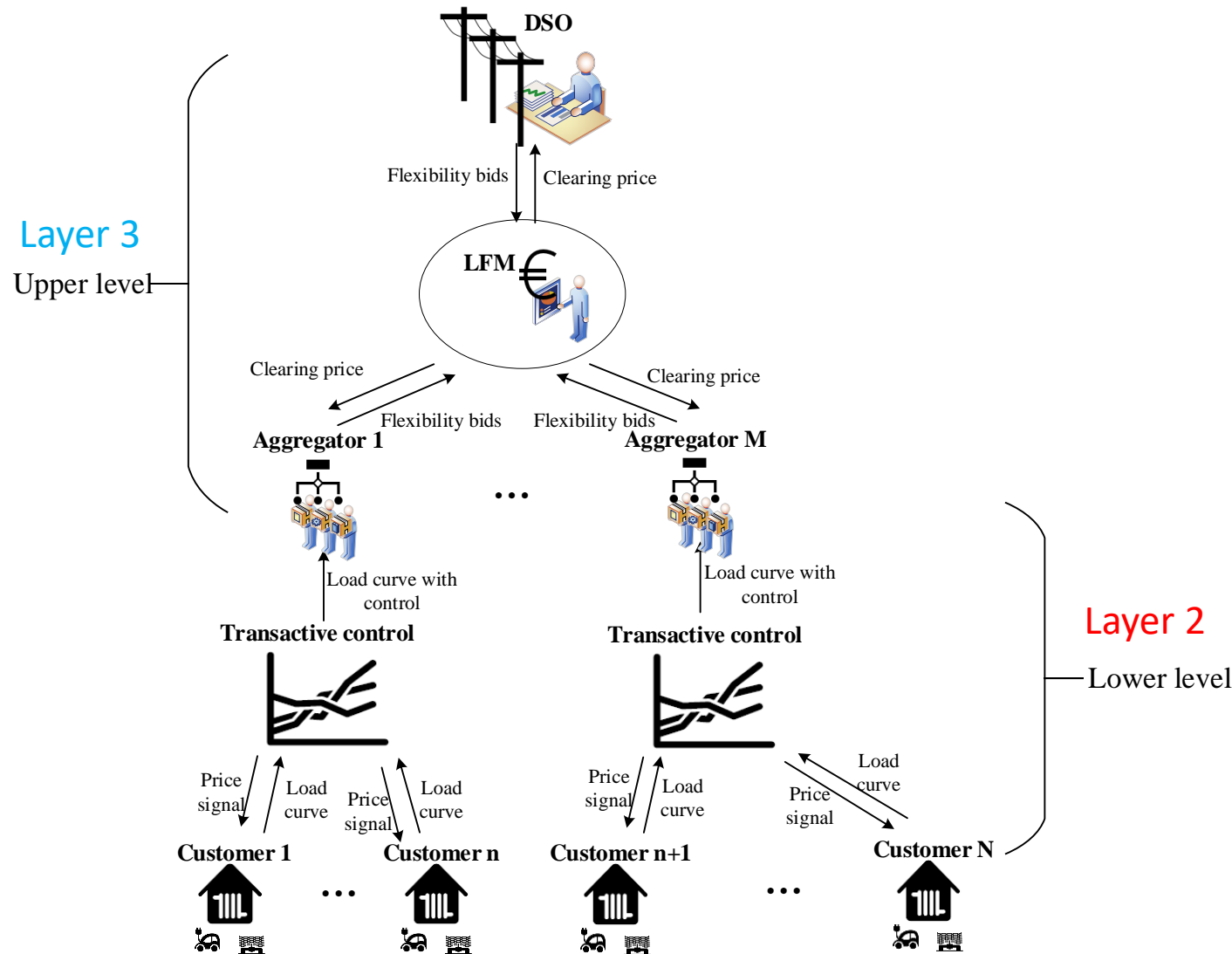
- There is a significant room for saving by increasing awareness of the consumers/prosumers!
- Community aggregators can facilitate this saving!



# Most Valuable Insight Gained in the Project regarding the WG topic

## Layer 2 & 3:

- A local market, a local flexibility market (LFM) can be defined as an electricity trading platform to sell and buy flexibility in geographically limited areas



DSO submits its flexibility request according to its congestion condition



LFM operator clears the market



Each aggregator submits its flexibility bids through transactive control with customers



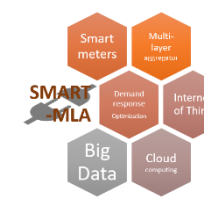
# Publications so far

## SCI

- Z. Ma, M. Xiao, Y. Xiao, Z. Pang, H. V. Poor and B (2019). High-reliability and Low-latency Communications for Internet of Things: Challenges, Fundamentals and Enabling Technologies. IEEE Internet of Things Journal (accepted).
- Ye, Y., Xiao, M., & Skoglund, M. (2019). Decentralized Multi-Task Learning Based on Extreme Learning Machines. arXiv preprint arXiv:1904.11366.
- Zhan, M., Pang, Z., Dzung, D., Luvisotto, M., Yu, K., & Xiao, M. (2019). Towards High-performance Wireless Control:  $10^{-7}$  Packet Error Rate in Real Factory Environments. IEEE Transactions on Industrial Informatics.
- Yue, J., & Xiao, M. (2019). Coded Decentralized Learning with Gradient Descent for Big Data Analytics. IEEE Communications Letters.
- Yang, P., Xiao, Y., Xiao, M., Guan, Y. L., Li, S., & Xiang, W. (2019). Adaptive Spatial Modulation MIMO Based on Machine Learning. IEEE Journal on Selected Areas in Communications, 37(9), 2117-2131.

## Conference

- Ertekin, Ş., Keysan, O., Göl, M., Bayazit, H., Yıldız, T., Marr, A., ... & Özkavaf, S. (2019, June). METU Smart Campus Project (iEAST). In International Conference "New Technologies, Development and Applications" (pp. 287-297). Springer, Cham.
- S.V. Oprea, A. Bâra, V. Diaconița, D. Preoțescu, O.B. Tor. (2019, October). Big data solutions for demand response management (ICSTCC). 23rd International Conference on System Theory, Control and Computing. Sinaia, Romania.
- G. Ifrim, S.V. Oprea, A. Bara . (2019, October). Shifting Optimization Algorithms for Flattening the Electricity Consumption Peak (ICSTCC). 23rd International Conference on System Theory, Control and Computing. Sinaia, Romania.
- Oprea, S. V., & Bâra, A. (2019). Distributed database on blockchain technology for new era of electricity transactions. Scientific Bulletin" Mircea cel Batran" Naval Academy, 22(1), 1-9.
- Simona-Vasilica Oprea, Adela Bâra and Dan Preoțescu. (2019). Data framework for electricity price setting in competitive environment. Scientific Bulletin" Mircea cel Batran" Naval Academy.
- Oprea, S. V., & Bâra, A. (2019). Big Data Solutions for Efficient Operation of Microgrids. Ovidius University Annals, Economic Sciences Series, 19(1), 266-271.
- Simona Vasilica OPREA, Anca Ioana Andreescu, Anda Belciu (Velicanu). (2019, May). Blockchain solutions for peer to peer electricity transactions. 18th International Conference on Informatics in Economy, IE 2019Bucharest.
- L. Berntzen, T. Brekke and M. Rohde Johannessen. (2019, July). Multi-layer aggregation in smart grids – A business model approach. 5th International Conference on Connected Smart Cities (CSC) 2019. Porto, Portugal, 16th -19th.



## OPEN QUESTIONS AND BARRIERS

(HOW COULD PEER EXPERTS SUPPORT YOUR PROJECT?)

- 🌱 Knowledge on smart contract mechanisms (block-chain, etc.)
- 🌱 'Flexibility market' business models from different countries
- 🌱 Business models / pricing mechanisms for demand-side management at DSO level

## WE OFFER EXPERIENCE IN...

(AREAS OF EXPERTISE & EXPERIENCE TO SHARE)

- 🌱 Developing concepts for aggregator mechanisms
- 🌱 Developing tools for market players:
  - 🌱 Community aggregators
  - 🌱 Prosumers
  - 🌱 DSO



Based on our challenges to successful research and implementation, we have developed the following messages:

“Dear **providers of funding**,  
you should grant specific funds to citizen associations.

This is important, because **citizens are key players in demand side management concepts** which our project is focusing on!

“Dear **developers and managers of funding initiatives**,  
you should facilitate exchange among funded projects.

This is important, because we think that such exchange will help us **clarifying open questions** mentioned in the previous slide!

Based on our challenges to successful research and implementation, we have developed the following messages:

“Dear **politicians** (national / EU-level),  
you should develop and foster instruments which are open for new solutions and are not limited to specific technologies.

This is important, because we saw in our project that implementation of demand side mechanisms in real market environment requires **adoption of new market instruments including legislations**

“Dear **business associations** (national and EU-level, e.g. entso-e, bdi, vku),  
you should enable access to funding for citizen associations.

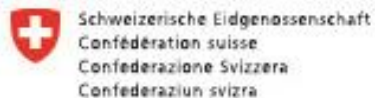
This would enable **rationality of the concepts and tools** we develop in our project from business associations point of view.



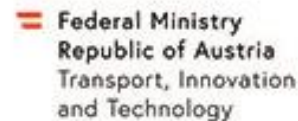
ADEME



Agence de l'Environnement et de la Maitrise de l'Énergie



Swiss Federal Office of Energy SFOE



NATIONAL RESEARCH, DEVELOPMENT AND INNOVATION OFFICE HUNGARY



Schweizerische Eidgenossenschaft Confédération suisse Confederazione Svizzera Confederaziun svizra Swiss Confederation Innosuisse – Swiss Innovation Agency



FOND ZA ZAŠTITU OKOLIŠA I ENERGETSKU UČINKOVITOST



FLANDERS INNOVATION & ENTREPRENEURSHIP



Flanders State of the Art



Smart Energy Systems ERA-Net

## Funding Partners



This initiative has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreements no. 646039 and no. 775970.