



Software tools for smart energy communities and system operators

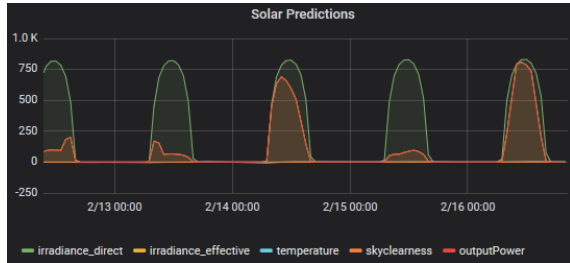
AAF/FF Workshop 11th of May 2020

Laurynas Šikšnys

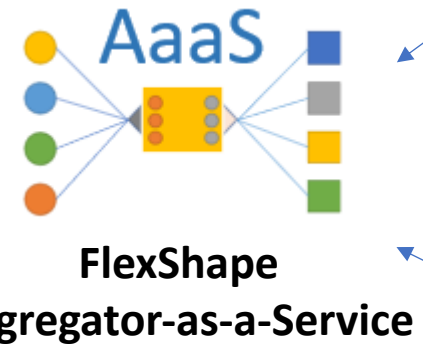
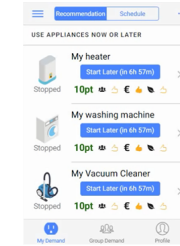
Laurynas@flexshape.dk

The landscape of the FlexShape solutions

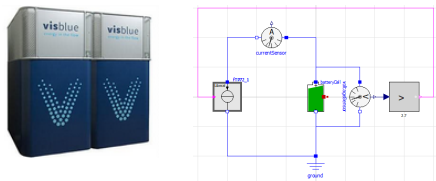
FlexShape Solar Predictor



FlexShape Energy Planner



FlexShape Battery MPC controller

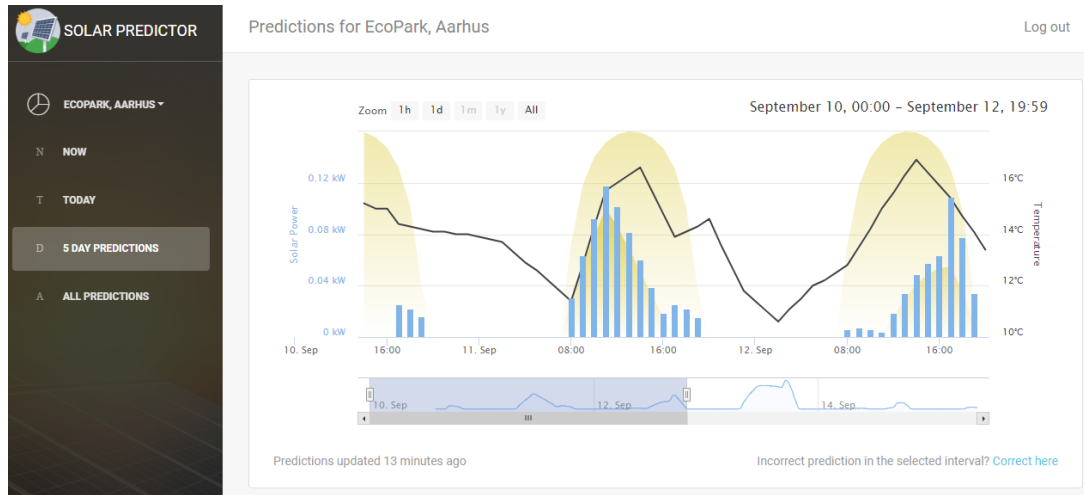


FlexShape Flexibility Market



Metering Point	Delivery Accuracy	Validation Type
Device	Low	<input type="checkbox"/> No Validation
Prosumer	Medium	<input checked="" type="checkbox"/> Photo/Video
Community	High	Measurements
36 combinations of products		<input checked="" type="checkbox"/> All Types

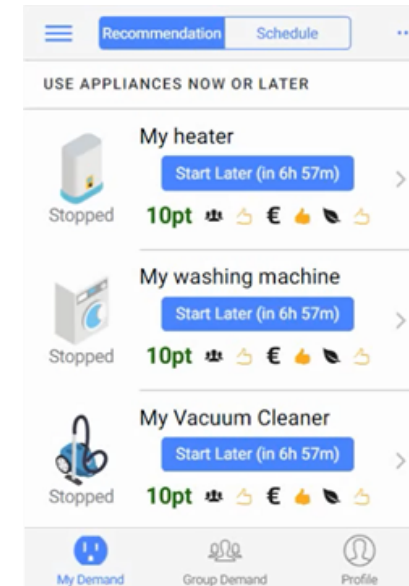
FlexShape Solar Predictor



Predicts photo-voltaic (PV) supply at any LAT/LONG for the next 5 days with minimal user configuration

- *Uses current weather data and forecasts from OpenWeatherMap*
- *Predicts immediately and learns from user corrections*

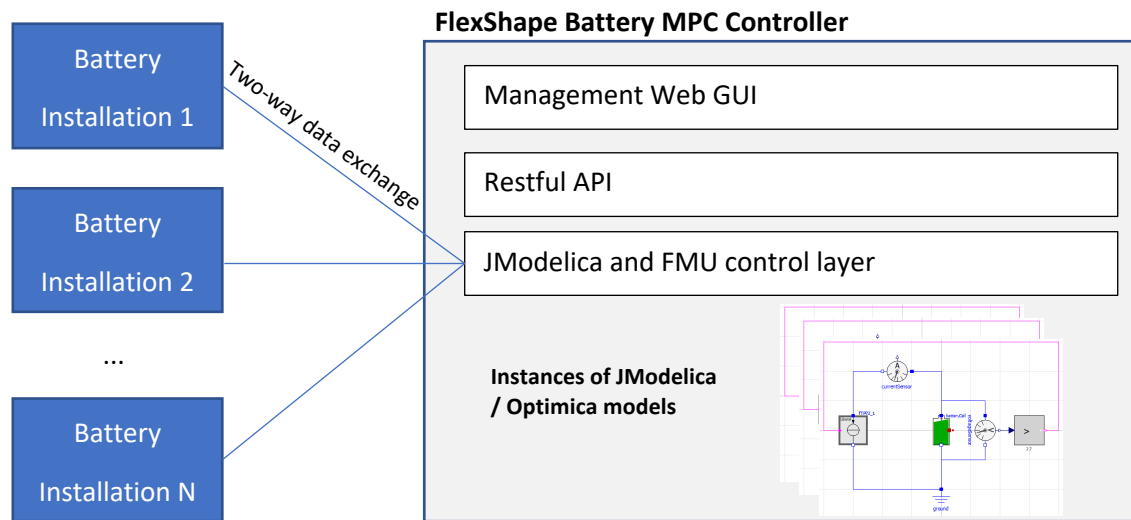
FlexShape Energy Planner



Predicts and optimizes residential loads through recommendations and automatic activations







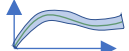

- *Can optimize for CO₂, price, peak-reduction, ...*
- *Groups/ social interaction*

FlexShape Battery MPC Controller



Allows optimizing physical batteries and/or heat-pumps using Modelica models and Model-Predictive-Control (MPC) techniques

FlexShape Flexibility Market

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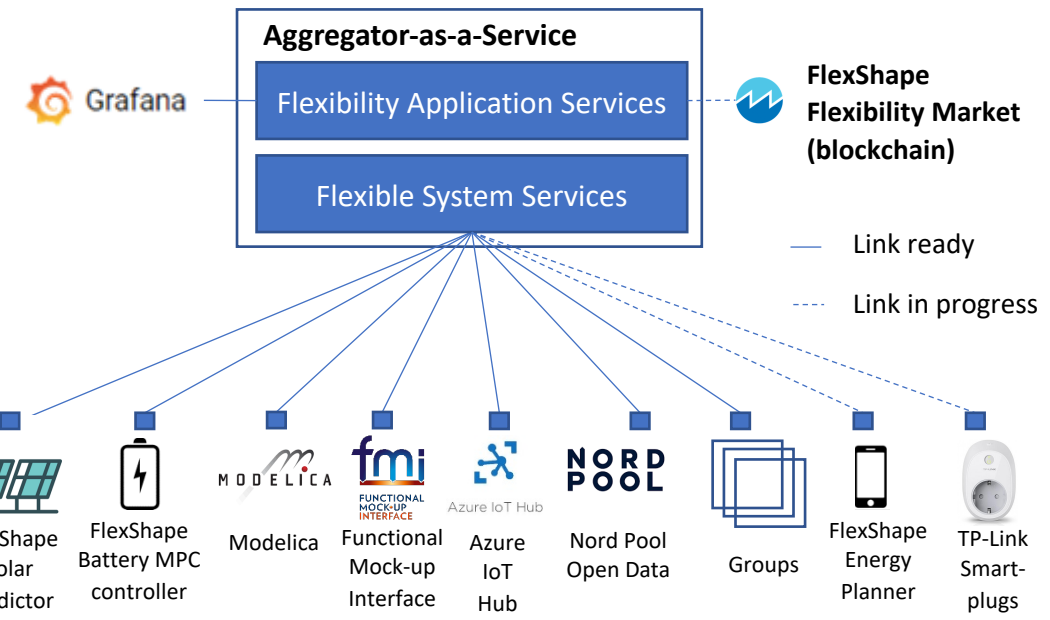
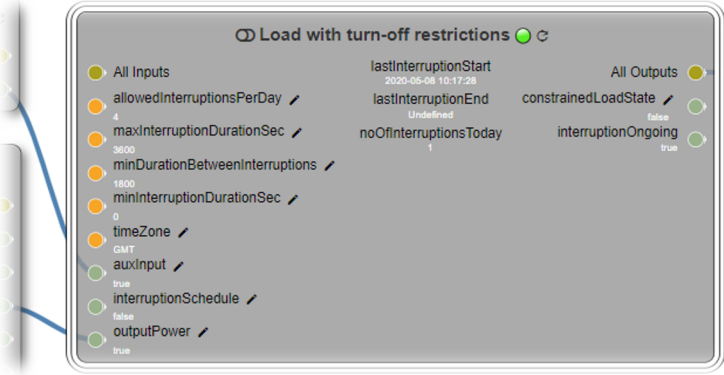
April 21st 2018, 10:22:33f5913b-71b9-4926-97b1-55bf77554eab		
3.2-4.8 kWh over 2 hours		0 kr
REQUESTED	DEVICE (LOW, NOVALIDATION)	@CS Department, AAU
April 21st 2018, 10:22:4e772413-25f8-471c-9bd2-13c81ac1ac04		
3.3-4.8 kWh over 2 hours		1.25 kr
REQUESTED	DEVICE (LOW, NOVALIDATION)	@CS Department, AAU
April 21st 2018, 9:08:d91f7d28-6f03-4758-b345-d0d1df7fe488		
3.2-4.8 kWh over 2 hours		0 kr
REQUESTED	DEVICE (LOW, NOVALIDATION)	@CS Department, AAU

Allows energy community members trading load flexibility in a blockchain flexibility market

FlexShape Aggregator-as-a-Service (AaaS)



FlexSystems ("Lego bricks" in AaaS)



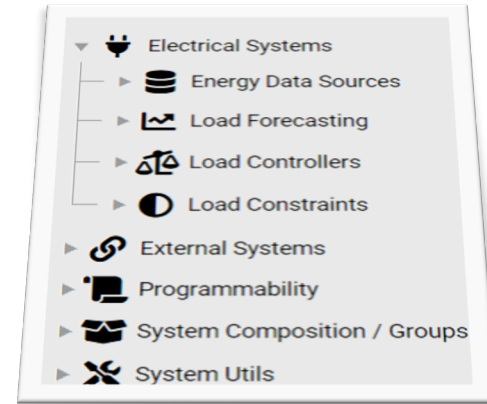
Vision: Build smart energy systems using Lego-like bricks


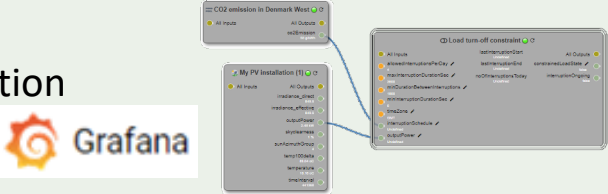

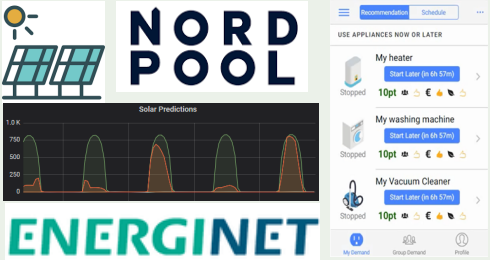
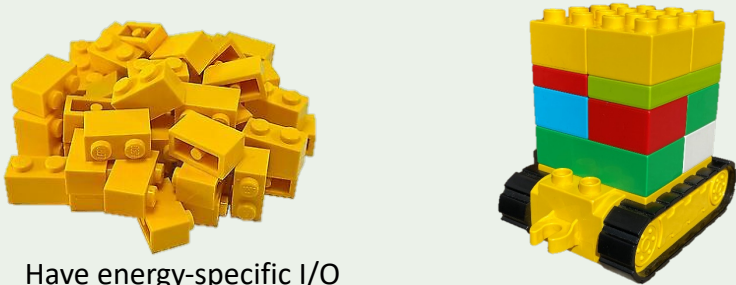

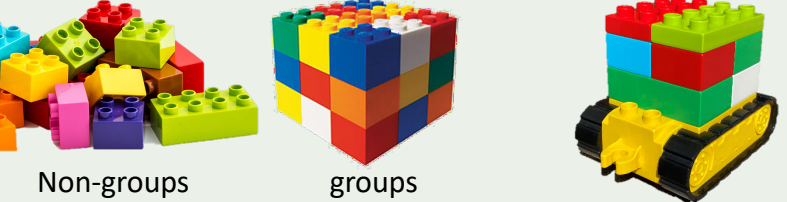

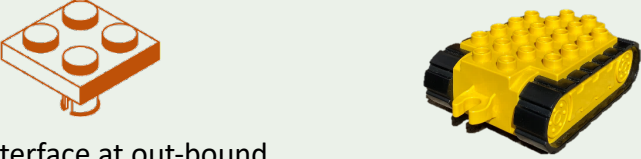
Concept: FlexSystems

- Report current and future states and flexibility (in real-time)
- Configurable
- Inter-connectable
- Composable
- Simulatable
- Optimizable

Realization: AaaS – a rich eco-system of FlexSystems and applications

- Distributed by design
- Cloud-ready
- Based on reactive (big) data streams
- Language neutral



	solutions / modules / packages	interfaces / type of provision
business applications	<ul style="list-style-type: none"> - Self-Consumption, energy procurement, DR/load balancing, CO₂ optimization, peak shaving, battery control, flexibility trading (prosumers, DSOs, housing associations), ... 	
high level services	<ul style="list-style-type: none"> - Interactive system modelling - Real-Time monitoring & visualization - Load sharing in communities 	
(energy-) domain specific enablers	<p>Energy-specific components:</p> <ul style="list-style-type: none"> - FlexShape SolarPredictor - FlexShape Energy Planner APP - Nord Pool / EnergiNET Data Importer - Load controllers & predictors - Battery, heat-pump models, DataLake... 	 <p>Have energy-specific I/O</p>
usage area independent (generic) enablers	<p>(Generic) modelling tools:</p> <ul style="list-style-type: none"> - Modelica models (simulation & optimization) - Fuctional Mock-up Units - Groups (encapsulation, aggregation), ... 	 <p>Non-groups groups</p>
supported physical entities	<p>Physical-system connectors:</p> <ul style="list-style-type: none"> - TP-Link Smart-plugs - PLCs/Azure IoT Hub - FlexOffer-based loads - EEBus, OpenHab, ... 	 <p>Std. interface at out-bound</p>

Questions?

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