› VALUEFLEX

Presentation to IEA-DSM at IEEE PowerTech 2015
Stephen Galsworthy | 29/6/15

TNO innovation for life

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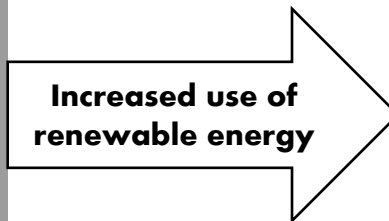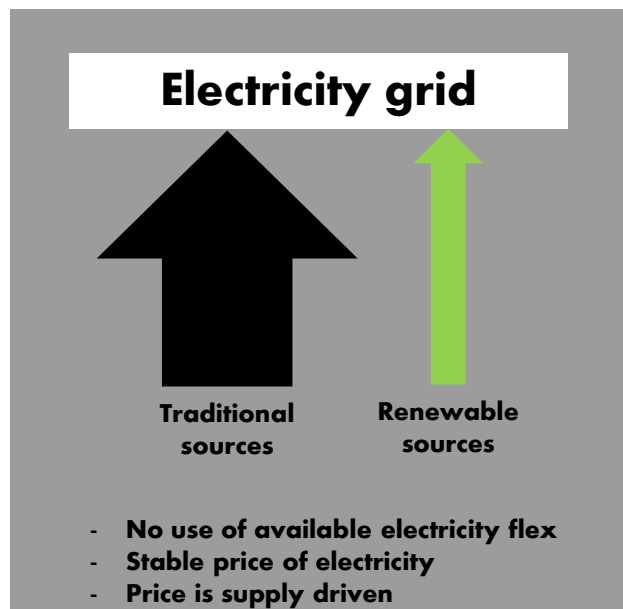**Consultant**   **M +31 (0) 64 696 60 65**
Technical Sciences   **E stephen.galsworthy@tno.nl**
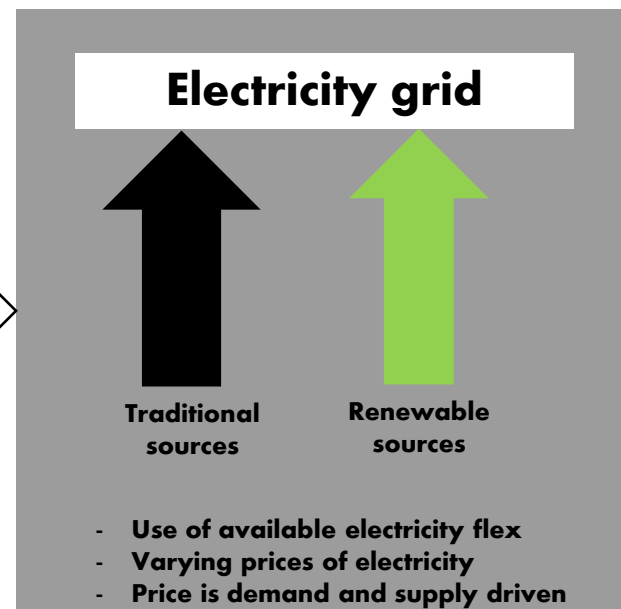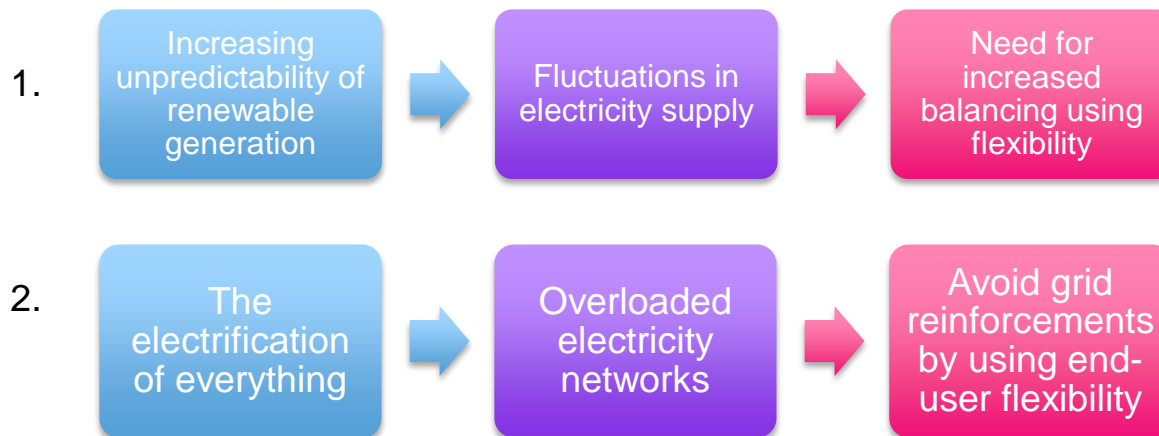
THE VALUE OF FLEX

› Electricity Flexibility has a Value

› Energy customers have a large flexibility potential:
    › Demand Response
    › Response of Distributed Generation.

› Two reasons for value increase

1. | Increasing unpredictability of renewable generation | → | Fluctuations in electricity supply | → | Need for increased balancing using flexibility |

2. | The electrification of everything | → | Overloaded electricity networks | → | Avoid grid reinforcements by using end-user flexibility |

VALUE DRIVERS FOR E-FLEX

› Electricity supply: B2B & B2C Electricity resellers
  › Value Driver: optimize wholesale market position

› Network Management: Distribution System Operators
  › Value Driver: deferral of network investments
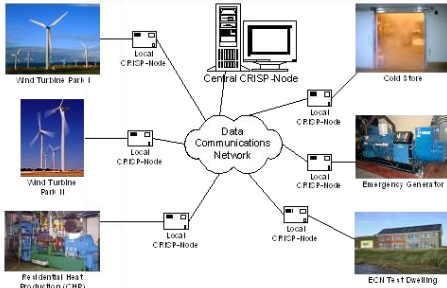
PowerMatcher
Coordination for the Smart Grid

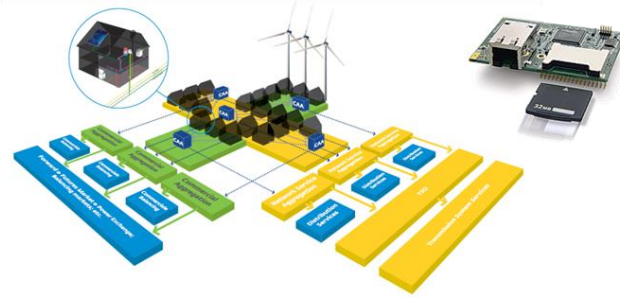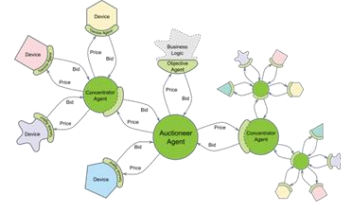**Energy optimization of high numbers small units (<5MW)**

Demand Response

Distributed Generation

Storage (Electrical Vehicles)

Industrial Installations Domestic Appliances

Business Cases

Energy Trading

Active Distribution

Virtual Power Plant

Imbalance Reduction

Congestion Management

Black-Start Support

VISION FOR VALUEFLEX

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VALUEFLEX

› ValueFlex is a KIC InnoEnergy project carried out by:

› Global Commercialization Partner:

› Uniqueness:
  › It offers feasibility services based upon a comprehensive set of simulation tooling
  › To analyse the economic and technical feasibility of demand response services in specific real world business cases.

The business driver is to provide insight in costs vs benefits of investments, based on scientifically proven algorithms, exploiting electricity flexibility.

RESULTS & OPPORTUNITIES

› ValueFlex Expected Project Results
  › **Toolbox** to analyse the economic and technical feasibility of demand response services.
  › Systematic and targeted **feasibility analysis services**.
  › **Validation** of the analysis service in specific real world business cases

› Business opportunities
  › **Licensee for Toolbox usage**
  › **Feasibility Analysis Service** for Demand Response Schemes

PRODUCT OVERVIEW

PRODUCT OVERVIEW

Simulation ToolBox

Demand Response Simulator

Grid Models

Market Models

Input Data

Device Information
Prices (Market & Tariffs)
Capacity Boundaries
Network Topology
Existing Portfolio

Models used by the customer

Output

Available Flexibility
Reliability of Flexibility
Potential Benefit
Potential Risk
Calculated Investment Estimate
Gap Analysis
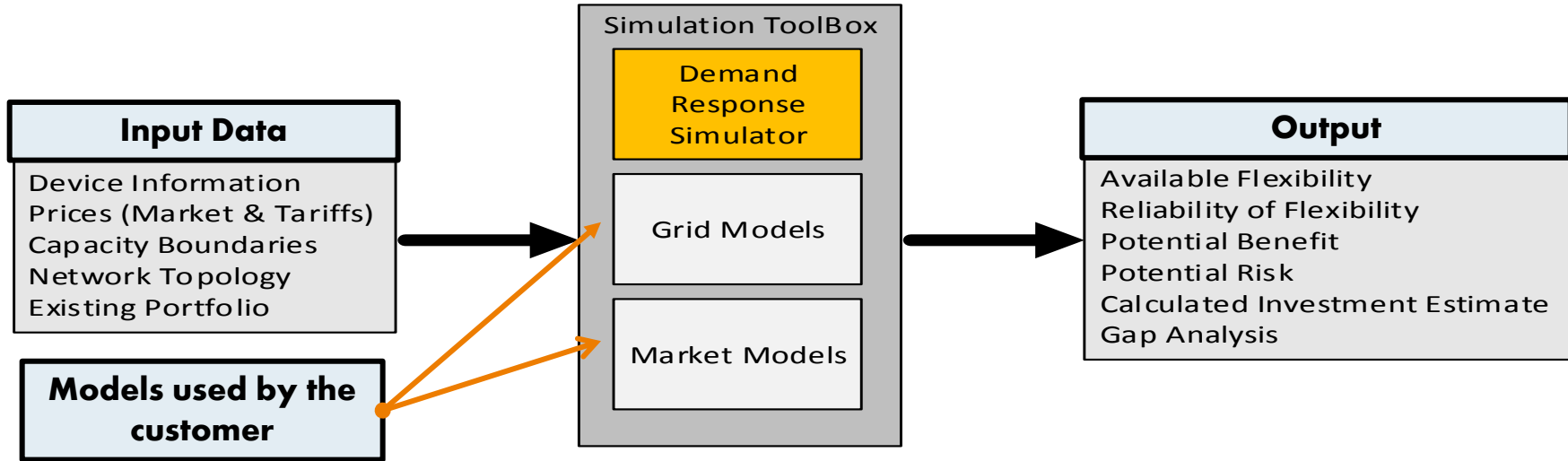
› Compatibility with:
   › Power Flow through OPC-standard: PowerFactory, Aristo.
   › Different Market contexts
   › Different DR Approaches

FEASIBILITY SERVICES

FEASIBILITY SERVICES: PROVIDING INSIGHTS FROM VALUEFLEX TOOLBOX

› **Aim:** Give insight into the business value of electricity flexibility available at energy customers in the specific case of the client

› **Target clients:** Parties interested in how VPPs can be used for:
   › Solving problems related to grid operation (DSOs, TSOs, etc)
   › Economic gain in markets (Energy Traders, Suppliers, BRPs, Aggregators, etc)

FEASIBILITY SERVICES FOR DSOs

Example Feasibility Study: DSO balances high PV generation with heat pumps

› **Business driver**: Use heat pump E-Flex in a particular area to balance PV generation: avoids overloading network, delays/defers infrastructure investment

Steps:

› **Assess potential portfolio** to select potential flexible heat pumps
  › Select or create corresponding models.
› **Assess generation characteristics** of PV generation in the grid network
  › Select or create corresponding models.
› **Realise the grid context** in the SimTool: Historic and/or future levels for PV generation. Actual grid topology and locations.
› **Run Simulation**
› **Analyse**: Compare to simulations of grid scenario without using heat pump flexibility.
  Main Performance Indicator: Level of congestion avoidance

FEASIBILITY SERVICES FOR MARKET PARTIES

Example Feasibility Study: B2B Electricity Trade & Supply in NL

› **<u>Business driver</u>**: Use end-customer E-Flex to optimise position on the Balancing Market: steer E-flex contrary to the TSO-level imbalance when prices for up/down regulation are high.

Steps:

› **<u>Assess B2B contract portfolio</u>** to select potential flexible customers
  › E.g. Freezing Houses, Pump Capacity, etc.
  › Select or create corresponding models.
› **<u>Realise the market context</u>** in the SimTool: Historic prices for Day-ahead and Imbalance Markets.
› **<u>Run Simulation</u>**
› **<u>Analyse</u>**: Main Performance Indicator: Euros earned.

CUSTOMER INTEREST TO DATE

VATTENFALL — **"Searching for software tooling to calculate grid reinforcements vs required investments. "**
Confirmed launching customer when first viable product becomes available.

NUON — **" If the product is available we will buy it. It will replace many point solutions we use today."**

STEDIN.NET — **" Investigating the use of point solutions. Our calculations now are guestimates."**

alliander — **"We estimate that we can save €20-30 million annually on grid reinforcements using flexibility."**

SIMULATION TOOLBOX

ValueFlex

Welcome

Weather Stations

Simulation

Developer Tools

Configuration

Configuration

Configurations will be initialized when starting the simulation. Please use the correct format.

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      "upperCutoff": 40,
```

Save Configuration

The scenario is defined in a JSON format and contains configurations having key/value properties. Examples are PowerMatcher configurations, such as auctioneers, concentrators and device agents (MicroCHP, PV panels, ...).

ValueFlex

Welcome

Weather Stations

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Simulation

From this page you can start the ValueFlex simulation. The simulation will run from the start date and increment this with the time step until it hits the end date.

Start Time

01-01-2011 12:00

End Time

31-12-2011 12:00

Time Step (in minutes)

5

Start Simulation

The next step is to define the simulation start time, end time, time step and to start the simulation. When you press this button, all configurations (from the previous step) will be initialized and the simulation will start.

ValueFlex

Configurator   Analytics   Maps   Documentation

Welcome

Weather Stations

Simulation

Developer Tools
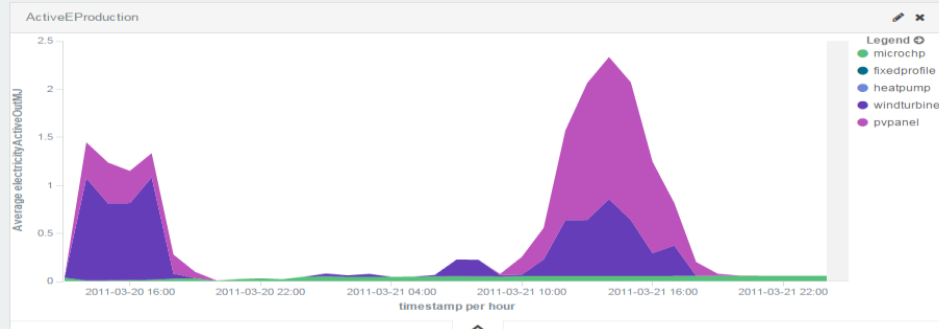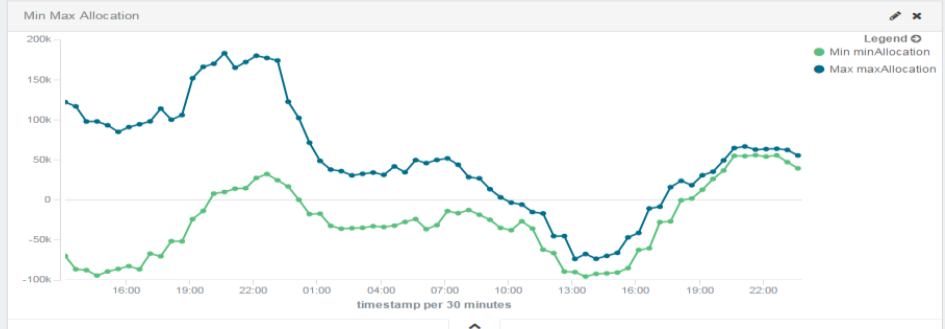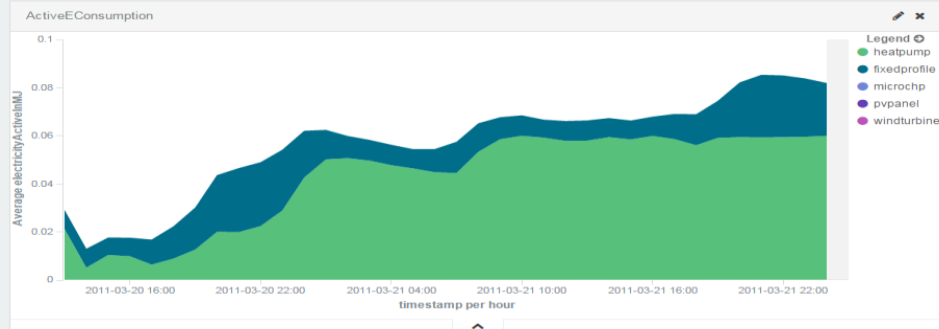
Configuration

Simulation

The simulation is currently in progress. Press Stop Simulation to terminate it.
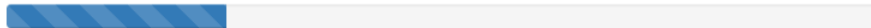
Current simulation time: **01-01-2011 12:30**

Stop Simulation

The progress and the current simulation time is displayed to the user. If required, the simulation can be stopped.

In this dashboard you see the consumption and production of all devices, the flexibility of the cluster as well as the 'PowerMatcher price' used by the PowerMatcher algorithm.

The user can add pre-defined visualizations to his dashboard, or create new ones.

PLEASE GET IN TOUCH

› We are interested in use cases that may help us in optimizing ValueFlex development
  › DSOs
  › TSOs
  › Traders/retailers
  › Aggregators
  › Policy makers / regulators

› Feel free to e-mail me at stephen.galsworthy@tno.nl

THANKS FOR YOUR ATTENTION!

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ADDITIONAL SLIDES

FEASIBILITY SERVICES FOR DSOs

Potential uses of ValueFlex (1):

›	Capacity management and voltage control
›	Keep the system running within security standards through generation/demand adjustment
›	ValueFlex assesses: Relative benefit of solutions using additional flexibility in the near term

›	Grid planning and optimising distribution network capacity investments
›	Investing efficiently in distribution grids (e.g. through peak shifting)
›	ValueFlex assesses: The value of flexibility as an alternative to network reinforcement

FEASIBILITY SERVICES FOR DSOs

Potential uses of ValueFlex (2):

›   Local demand response and feed-in management
- ›   Maximising DER connection and integration
- ›   Reduced curtailment of distributed generation and reduced outage times
- ›   ValueFlex assesses: level of curtailment that can be avoided using flexibility, value attached

›   Reduce technical losses
- ›   Transport from generators to consumers creates network losses
- ›   ValueFlex assesses: How flexibility can help to reduce such losses, amount of electricity prevented from being lost

FEASIBILITY SERVICES FOR MARKET PARTIES

Potential uses of ValueFlex:

› Arbitrage
  › ValueFlex assesses: Benefits and risks of using different kinds of flexibility for trading on energy markets

› Minimizing balancing energy costs/penalties
  › ValueFlex assesses: Benefits of trading different kinds of flexibility on Imbalance market

› Portfolio optimisation
  › Access to both flexible generation and demand resources increases options for optimisation
  › ValueFlex assesses: Value of using different kinds of flexibility in your portfolio