A fully operational virtual energy storage network providing flexibility for the power system

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2012: Foundation of Swisscom Energy Solutions Ltd.

2013: Ancillary services market entry with mFRR in Switzerland

2014:
• Launch of tiko power
• aFRR market entry in Switzerland

2016:
• FCR market entry in Switzerland
• Launch of new products tiko sun and tiko mountain

2017:
• Successful prequalification for FCR in France
• Rollout in Germany
• Pilot project in Austria
• Launch of tiko storage
The **tiko** Demand Management Platform

- **Climate Sensor**
- **M-Box**
- **Private Cloud**
- **Web**
- **App**
- **K-Box**

**Actors and sensors** → **Gateway** → **Backend/Algorithms** → **Front-end**
1: M-Box: Communication module (one per house)
2: K-Box: Measurement and control module (one per device)
tiko power Control Aspects

Local weather conditions

Consumer behavior

Consumer comfort

Utility ripple control

Ancillary service requirements

Device properties and state
Example: Air-to-Water Heat Pump
Example: Brine-to-Water Heat Pump

Graphical Overview

Total: 38.8 kWh

2/1/2017

Other heating
More than 10,000 residential heating systems connected

Prequalified and in operation
- aFRR since 2014
- FCR since 2016
Ancillary Services for Transmission Grids

**Automatic Frequency Restoration Reserves (aFRR)**
- Receive and follow an activation signal from power system operator
- Real-time control on second-by-second basis

**Frequency Containment Reserves (FCR)**
- Measure power system frequency and activate power according to deviations from 50 Hz
- Real-time control on second-by-second basis
Example for aFRR

Request from power system operator

Response of tiko pool
Example for FCR

- Frequency measurement
- Response of tiko pool
Value Proposition for tiko Participants

Monitoring
Detailed consumption analysis and comparison with other users

Comfort & Savings
Remote control Eco mode for energy savings

Security
Alarming system for device failure
## Special Characteristics of tiko

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>1</strong></td>
<td><strong>Small loads</strong></td>
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<tr>
<td>1</td>
<td>Focus on domestic loads, mainly electricity based residential heating</td>
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<tr>
<td>2</td>
<td>Small and medium enterprises</td>
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<tr>
<td>3</td>
<td>Creating additional value for participants</td>
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<td><strong>2</strong></td>
<td><strong>Proven concept</strong></td>
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<tr>
<td>4</td>
<td>First aggregator in the world providing dynamic aFRR and FCR with domestic loads</td>
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<td>5</td>
<td>24 x 7 operations since 2014</td>
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<td><strong>3</strong></td>
<td><strong>In-house development hardware/software</strong></td>
</tr>
<tr>
<td>6</td>
<td>All options for parameterisation</td>
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<tr>
<td>7</td>
<td>Changes and further developments are easy to integrate</td>
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<tr>
<td><strong>4</strong></td>
<td><strong>Data and control per second</strong></td>
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<tr>
<td>8</td>
<td>Real-time power measurement of each device in the pool</td>
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<td>9</td>
<td>Individual control commands to each device</td>
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<td><strong>5</strong></td>
<td><strong>Centralized and decentralized intelligence</strong></td>
</tr>
<tr>
<td>10</td>
<td>Intelligence can be centralized or decentralized depending on application</td>
</tr>
<tr>
<td>11</td>
<td>Combinations of centralized and decentralised intelligence</td>
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**tiko**
tiko Modular Packages

**House**
- BE – Algos / data mgt.
  - Intra-day / Peak shaving / Tertiary
  - Primary control
  - Secondary control
  - PV self consumption optimization
  - Battery management
  - Mountain railways
  - Ripple control replacement/ext.
  - Eco-Mode and Alarming

**Operation systems**
- Box FW upgrade management
- Monitoring and alarming system

**ERP**
- Campaign management
- Registration management
- Intervention planning man.
- Installation management
- Customer management

**Consumer web/app**

**Customer Support Portal**

**Partner portal / install. app**
tiko in EKS Sun Control

Verbrauch
Gestern / Heute
28,8 kWh / 14,1 kWh

Eco Mode
Normal

Alarme
Die M-Box ist seit mehr als 3 Tagen nicht mehr verbunden

Sonnenenergie
Derzeitige Produktion
3,3 kW

Grafische Darstellung
14/3/2016 bis 20/3/2016

Day

Week

Month
tiko Future Developments for Heat Pumps

- Integrate heat pumps in the existing PV self consumption optimization
- Device state detection and analysis based on real-time second-by-second measurement data
- Integrate additional standardized heat pump interfaces
Thank you!

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• **Individual measurement and control**
  Every device is individually measured and controlled according to its characteristics and consumption behavior.

• **Consumer comfort**
  The devices are controlled in a way that doesn’t affect the consumer comfort.

• **Multi-client capability**
  tiko can be used by different parties for different applications – network operators, energy suppliers, etc.

• **Service for the end-users**
  tiko provides additional services for end-customers.
tiko Control Performance
tiko Control Performance

\[
AD_{\text{tol}} = \frac{\sum_{t=0}^{t_{\text{d}}} P_{\text{diff}} \cdot t_t}{P_{\text{sek}} \cdot t_{\text{d}}} \cdot 100\%
\]

Required: \( AD_{\text{tol}} \leq 1\% \)

Achieved: \( AD_{\text{tol}} = 0.01\% \)