evolvDSO Project
Definition of KPIs

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evolvDSO project

FP7 Call for proposal: Energy.2013.7.1.1

Project Consortium:
16 partners including DSOs, TSOs, renowned research institutions, association, new market players.

Duration:
September 2013 – December 2016

Project budget: 7.8 M€
Project funding: 5.2 M€

Development of methodologies and tools for new and evolving DSO roles for efficient DRES integration in distribution networks

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Why is evolvDSO relevant in the current context?

Wide array of **distributed energy resources** are allowing and requiring changes in the way DSOs plan and operate the networks under their responsibility.

- **What new roles must the DSO assume** to adapt to the changing energy paradigm, while maintaining necessary quality of supply standards?
- **What new services** can the DSO provide in the future in order to better support the energy markets?
- **What new tools/methodologies** must be developed to support these new roles?
- **How must regulation and markets be adapted** to support a cleaner and more efficient energy system in line with the new DSO role?
- **What is the potential impact of the tools and methodologies** that are developed and demonstrated?
From Uses Cases to WP3 Tools

- Business Layer
  - DSO future roles
  - Smart Grids services
  - Functional challenges
  - Business Use Cases
- System Layer
  - DSO future roles
  - External actors analysis
  - Analysis regulatory framework
  - System Use Cases

- Existing regulatory frameworks and market architectures
- Future Scenarios
- Power Distribution facts & figures (RES penetration)

- Final List of Tools
  - WP3
  - DSOs interest assessment (no interest, low, medium, high)
  - Preliminary list of innovative tools from the SUC

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From System Use Cases to developed tools and KPIs

System Use Cases

10 innovative tools

KPI definition

Data collection

**DOMAIN: NETWORK PLANNING & CONNECTION**

- Elaborate load generation, connection and contract forecast
- Perform network calculation for determination of criticalities
- Analyze flexibility and reinforcement needs

**DOMAIN: OPERATIONAL PLANNING**

- Identify and solve network constraints for a given zone and an optimisation application period in operational planning
- Solve network constraints using optimisation levers based on a metier order
- Identify network constraints in operational planning

**DOMAIN: OPERATION & MAINTENANCE**

- Decide asset renewal priorities
- Optimize maintenance programs

**DOMAIN: DSO-TSO COOPERATION**

- Optimize the network by providing active and reactive power profiles to the TSO
- Estimate flexibility range of the Primary Substation

**EEGI**

- Identification of the tools’ relationships with the overarching EEGI KPIs
- Definition of the calculation methodologies based on the features of the tool

**Operational KPIs**

- In order to accurately assess the quality and performance of the tools it has been necessary to include more granular KPIs which were developed by Research Institutes

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KPIs definition: Impact and operational KPIs

<table>
<thead>
<tr>
<th>Specific KPIs</th>
<th>Number of tools with impact on KPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased RES and DER Hosting capacity</td>
<td>5</td>
</tr>
<tr>
<td>Reduced curtailment of RES and DER</td>
<td>5</td>
</tr>
<tr>
<td>Power Quality and Quality of supply</td>
<td>5</td>
</tr>
<tr>
<td>Extended asset lifetime</td>
<td>2</td>
</tr>
<tr>
<td>Increased flexibility from energy players</td>
<td>2</td>
</tr>
<tr>
<td>Improved market competitiveness</td>
<td>0</td>
</tr>
<tr>
<td>Increased EV and other loads hosting capacity</td>
<td>1</td>
</tr>
</tbody>
</table>

Tool Operational KPIs:
- e.g. Reduction of time to calculate network losses
evolvDSO Tools – EEGI KPI Matrix

- **DSO–TSO Cooperation**
  - Interval Constrained Power Flow
  - Sequential OPF
  - State Estimation
- **Operational Planning**
  - Voltage Control
  - Operational Planning
  - Co-Simulation
  - Replay
- **O&M**
  - Advanced Asset Management
  - FLEXPLAN
  - TOPPLAN
- **Network Planning**
  - Increased RES & DER Hosting Capacity
  - Reduced energy curtailment of RES & DER
  - Power Quality & Quality of Supply
  - Extended Asset Lifetime
  - Increased Flexibility from Energy Players

**Key Focus Areas**:
- Increased RES & DER Hosting Capacity
- Reduced energy curtailment of RES & DER
- Power Quality & Quality of Supply
- Extended Asset Lifetime
- Increased Flexibility from Energy Players

**Projects Supported**:
- D3.4
- D5.1

**Evolution of Tools**
- EvolvDSO Tools
  - FLEXPLAN
  - TOPPLAN
  - Operational Planning
  - O&M
  - Network Planning

**Benefits**
- Increased RES & DER Hosting Capacity
- Reduced energy curtailment of RES & DER
- Power Quality & Quality of Supply
- Extended Asset Lifetime
- Increased Flexibility from Energy Players
All the KPIs have been defined by the Consortium through the use of a commonly agreed template
<table>
<thead>
<tr>
<th>KPI Name</th>
<th>Power Quality and Security of Supply</th>
<th>KPI ID</th>
<th>#3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scope of KPI</strong></td>
<td>To measure operational aspects</td>
<td>☑</td>
<td></td>
</tr>
<tr>
<td></td>
<td>To address EEGI objectives</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Strategic Objective</strong></td>
<td>The aim is to determine the extent that subtool 2, <em>enhanced maintenance priorities</em>, can offer insights that improve the power quality and quality of supply</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>KPI Description</strong></td>
<td>The KPI measure the improvement in supply quality that this tool can provide</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>KPI Formula</strong></td>
<td>[ CML_{KPI}[%] = \left( \frac{CML_{enh}}{CML_{bau}} \right) \times 100% ]</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Where <em>CML</em> is the anticipated <em>C</em>ustomer <em>M</em>inutes <em>L</em>ost for both the baseline (BAU) case, as well as when maintenance is undertaken in accord with enhanced priorities (enh)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Unit of measurement</strong></td>
<td>%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Relevant Standards</strong></td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Explanation of the Link with other relevant defined KPIs (Within the same tool)</strong></td>
<td>N/A</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Expected link with EEGI KPIs</strong></td>
<td>EEGI Power Quality of supply</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## B) KPI CALCULATION METHODOLOGY

<table>
<thead>
<tr>
<th>KPI Step #</th>
<th>Step description (max 50 words)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CML calculation assuming assets are maintained under typical regime</td>
</tr>
<tr>
<td>2</td>
<td>CML calculation assuming assets are maintained under enhanced regime</td>
</tr>
<tr>
<td>3</td>
<td>Percentage comparison of the two figures.</td>
</tr>
</tbody>
</table>

## B) KPI DATA COLLECTION. The aim is to check if the data already defined in Deliverable D2.3 Data Set configuration are sufficient to calculate these KPIs.

<table>
<thead>
<tr>
<th>Data ID</th>
<th>Type of data</th>
<th>Source for Data collection</th>
<th>Location of Data collection</th>
<th>Frequency of data collection</th>
<th>Monitoring period</th>
<th>Data type already included in the RWTH matrix (D2.3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>Base line maintenance regime</td>
<td>DSO practice</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

## C) KPI BASELINE: Please refer to the reference value of the KPI in the Business As Usual case (=tool not applied)

<table>
<thead>
<tr>
<th>Source of baseline values</th>
<th>SIMULATED VALUES</th>
<th>LITERATURE VALUES</th>
<th>COMPANY HISTORICAL VALUES</th>
<th>VALUES MEASURED BEFORE THE BEGINNING OF THE TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>✅</td>
<td>□</td>
<td>□</td>
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</table>

Details of Baseline: Anticipated CML for network under typical maintenance regime

### GENERAL COMMENTS

The software tool is an insights engine and so definitively quantifying its performance numerically is challenging.
At a glance

Use of EEGI KPIs

EEGI Specific KPIs have been used by the project to link the results of the tools simulations with the main EU goals.
In cases where no possible to calculate concretely the KPI, a qualitative analysis was carried out.
According to the DOW, a summary of the KPI calculation analysis will be delivered in D5.3 (October 2016).

Use of Operational KPIs

The definition of Operational KPIs was essential for the scope of the project, i.e. to test the performance of the tools. The Consortium is evaluating the possibility to propose standardized KPIs to make performance of different tools comparable.

Future analysis

A subset of tools will be tested under real conditions in the last period. This allows the Consortium to compare the results of field test with the simulations carried out in 2015.

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