


<p><b>PROJECT:</b> ICT Platform for Holistic Energy Efficiency Simulation and Lifecycle Management Of Public Use Facilities</p>	
<p><b>DELIVERABLE TITLE:</b> Configuration and Deployment of the Developed Basic SOA System</p>	<p><b>Deliverable Number:</b> D 8.1 (confidential)</p>
<p><b>WORK PLAN:</b> The <b>objectives</b> of WP8 are the configuration, development and deployment of the <b>Integrated Virtual Energy Laboratory (IVEL)</b>, organised as a web-based platform according to the SOA approach and the integration of the system components developed in the work packages 3 to 7 so that they shall appear to the end user as one homogenous simulator operated via user friendly, perception-oriented dialogue and serving different end user groups with different attitudes, viewpoints and abilities.</p>	<p><b>Deliverable Main Authors:</b></p> <p>Tuomas Laine Ken Baumgärtel</p> <p><b>Co-Authors:</b> Reijo Hänninen, Raimund Zellner, Peter Katranuschkov</p>

### EXECUTIVE SUMMARY:

The IVEL is the overall HESMOS platform, which is developed using the service-oriented architecture (SOA) approach. It will include (1) services for energy and emission simulation that would typically precede decisions for design and retrofitting tasks initiated in result of detected under-performances in the facilities' management, (2) services for operative energy-related analyses regarding facilities control, operation and lifecycle management as well as (3) local background CAD and FM applications. The kernel of the platform will be provided by advanced BIM-based CAD and FM tools extended to support preliminary and final architectural design (including cost calculation and bills of quantities) but also capable of interacting with the energy analysis and simulation services.

**This Deliverable covers one task of the overall work performed in WP8, namely:**

- T8.1 Configuration and deployment of the developed basic SOA system

**The deliverable report is structured into three parts:**

In the **first part**, we present the configuration of the IVEL platform structured in the main modules: IVEL Core, CAD System and IVEL Connector, nD Navigator, Facility Management Tools, Energy Computing Tools and Third-Party Tools-

In the **second part**, the current status of the IVEL prototype is presented which involves the conversion of 1<sup>st</sup> level space boundaries to 2<sup>nd</sup> level space boundaries, the material mapping between different databases and the creation of the simulation model.

The **last section** provides a conclusion which enumerates the important results achieved so far.

**Three partners were involved in the RTD work and each partner has contributed from their expert viewpoint as follows:**

- **TUD:** Overall concept, IVEL Core configuration and test-bed;
- **OG:** Overall concept and configuration of the Facility Management tools;
- **NEM:** Configuration of the IVEL Connector and the nD Navigator.

At this stage, we have implemented the basis of the IVEL platform, which is grounded on a service-oriented architecture and allows the integration of various external applications and web services. We defined a generic core, which can be used for multiple simulation tasks through the realised concept of web-enabled communication coupled with advanced transaction management, data storage, user management and flexible workflow execution. The result is a distributed platform where multiple data sources, information services and computational software can be linked together. From this starting point, we shall proceed with the development of all steps of the eeBIM process outlined in the HESMOS Deliverables D2.1 and D2.2 (WP2), integrating the emerging services and tools from WPs 3 to 7.

The major achievement of this part of the work is the generality and flexibility of the realised approach. The IVEL Core is implemented as

### Deliverable Partners:



### Technologies:

Technol.	Role
OSGi	Module and service platform
SOAP	Framework for exchanging web service data
REST	Web service architectural style providing an alternative framework to SOAP
Axis 2	Engine for SOAP and WSDL
Apache Jersey	Engine for REST
Apache Camel	Rule-based routing engine for linking and parsing of data formats
Spring	Business application framework providing simple and flexible integration of other technologies
Spring dm	Extension of Spring for OSGi
Hibernate	Object-relational mapping
HSQldb	Relational database management system
Log4j	Application logging in the development and production phase
Eclipse RAP	GUI framework for rich internet application
JENA	Ontology implementation for Java

flexible as possible to allow future integration of various services and tools beyond HESMOS. Moreover, configuration of the platform is easy to do in standardised manner. Thus, even though interoperability and integration of independent legacy applications will always be an issue that will require dedicated interfaces, via the set of generic model management services and the used standard BIM as common information basis the process of adaption of the platform can be significantly facilitated and speeded up. All this can greatly improve the impact and the future uptake of the IVEL by the industry. On the short term and as practical proof of concept we are planning to adapt and use the IVEL in the recently started FP7 European project ISES (Intelligent Services for Energy-Efficient Design and Life Cycle Simulation)<sup>1</sup>. This will provide for early feedback and help to improve the platform functionality and include new aspects and features beyond the targets of HESMOS, such as parameter studies by parallel simulations using cloud technology, examination of the performance of different manufacturer components (e. g. different façade elements, windows, heaters), and testing the suitability of such elements in different types of rooms/buildings under different climatic conditions.

Underlying Model and Specifications	
<b>OWL</b>	Knowledge representation language for ontologies
<b>RDF</b>	Metadata model for enriched description of web resources
<b>CSV</b>	Data format to store data in plain text
<b>IFC</b>	The ISO standardized BIM data model
<b>WSDL</b>	Web Service Definition Language



Figure 1: IVEL Prototype

#### TAGS:

Virtual Energy Laboratory, Service-oriented architecture, Web service, Service orchestration, Service Workflow, Space Boundary Conversion

HESMOS is a 36 month project that started in September 2010 and comprises a Consortium of one university and five industry partners.

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<sup>1</sup> See: <http://ises.eu-project.info/>