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Executive Summary

This report constitutes Deliverable 2.1 Plan for dissemination and exploitation of the SEMIAH project. The report has been prepared by Dorthe Gårdbo-Pedersen, the Exploitation and Dissemination Manager of SEMIAH, with support from the rest of the consortium. It has further been updated by Rune Hylsberg Jacobsen, the project coordinator of SEMIAH.

The document is developed to outline a plan for raising awareness of the project and its results among stakeholders and to maximise the impact of communication efforts.

The plan contains an analysis of the SEMIAH target group, an overview of dissemination tools, and methods for monitoring the communication activities. Furthermore, the plan gives an overview of activities already carried out as well as future dissemination activities. Thus, the deliverable describes communication steps already undertaken and presents the planned further activities by the project partners.

The second part of the plan outlines the preliminary exploitation opportunities.

At first, there is a short overview of the market succeeded by an exposition of the market penetration barriers for Demand Response. Subsequently, the plan outlines the expected impact of the SEMIAH concept and its solutions.

Finally, there is a description of each partner's exploitation opportunities as seen at this stage of the project.

The plan for dissemination and exploitation hence concludes on the assessment of the best possible ways to disseminate and exploit project results to have the desired impact of the project.

Abbreviations

BEMS	Building Energy Management System
BRC	Balancing Group Coordinator
BRP	Balancing Responsible Party
D	Deliverable
DG	Distributed Generation
DoW	Description of Work
DR	Demand Response
DSO	Distribution System Operator
DSM	Demand Side Management
EC	European Commission
EDM	Exploitation and Dissemination Manager
EUW	European Utility Week
HA	Home Automation
HAN	Home Area Network
HEMS	Home Energy Management System
ICT	Information and Communication Technology
IoT	Internet of Things
KPI	Key Performance indicator
LV	Low Voltage
OGEMA	Open Gateway Energy MAnagement
PC	Project Coordinator
RES	Renewable Energy Sources
SEMIAH	Scalable Energy Management Infrastructure for Aggregation of Households
SEO	Search Engine Optimization
TRL	Technology Readiness Level
TSO	Transmission System Operator
URL	Uniform Resource Locator
VPP	Virtual Power Plant
WP	Work Package
WT	Work Task

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1 Introduction

1.1 Purpose and scope of D2.1 Plan for dissemination and exploitation

The D2.1 Plan for dissemination and exploitation is elaborated as part of the activities of work package 2 (WP2) in the SEMIAH project.

As indicated in the title, this deliverable is divided into two main parts, dissemination and exploitation. Since the dissemination activities of the SEMIAH project are only covered in this deliverable, they will be described thoroughly. The exploitation issues will be described at an introductory level and will be further elaborated in deliverable D2.3 Exploitation plan.

In the Description of Work (DOW), the objectives of the Exploitation and Dissemination work package are to:

- Ensure that all project results are formulated and compiled into a protectable form.
- Develop a dissemination strategy that will enable widespread publication of the project results.
- Ensure the consortium's ability to exploit the project results through knowledge sharing, documentation, and training.
- Consider and use the socioeconomic impact of the generated knowledge and technology to influence decision making institutions, end-users investments, and to create awareness around the solutions and products developed.

The plan for dissemination and exploitation will conclude on the assessment of the best possible ways to disseminate and exploit project results to have the desired impact of the project.

1.2 Introduction to SEMIAH

SEMIAH will pursue a major technological, scientific and commercial breakthrough by developing a novel Information and Communication Technology (ICT) infrastructure for the implementation of Demand Response[1] (DR) in households.

This infrastructure shall enable scheduling of high energy-consuming domestic loads' operation to off-peak demand periods for reducing the peak demand on the network. The project's innovative approach is based on the development of an open ICT framework that will promote an environment for the deployment and innovation of Smart Grid[2] services in households for load management.

The project partners develop a centralised system for DR services provisioning based on aggregation, forecasting, and scheduling of electricity consumption in domestic sector. The SEMIAH concept enables aggregation of all the households connected to the system and will act through direct load control to shift or curtail electrical loads considering user's flexibilities and utility demand limits.

The project delivers a hardware solution that enables control of selected electrical loads operation based on demand limits considering energy tariff. The solution consists of a number of smart plugs that can be controlled over a home area network through a gateway connected to a wide area

[1] Defined as "changes in electricity usage by consumers from their normal consumption patterns in response to price or other signals".

[2] Defined as "an electricity network that can intelligently integrate the behaviour and actions of all users connected to it – generators, consumers and those that perform borth – in order to efficiently deliver sustainable, economic and secure electricity supply", www.smartgrids.eu/FAQ#12.

network. The consortium integrates security and privacy functions to ensure that the system cannot be compromised.

In order to successfully implement SEMIAH, the consortium finally develops new business models for electricity players and residential customers to quantify costs and benefits for players in the value chain.

SEMIAH shall contribute to the benefit of residential customers, energy utilities, and the society in general through lowering electricity bills, and higher stability of the electricity grid. Hereby, the project will enable savings in CO_2 emissions and fuel costs, as well as reducing investments in electricity network expansions and electricity peak generation plants.

1.2.1 Consortium

In order to achieve project objectives and the projected impacts, a strong and determined consortium has been grouped around the technological skills and competencies needed to overcome the identified challenges.

The team of 12 partners from 4 different European countries, coming from ICT (AU, CSEM, UIA and HES-SO), Energy (Fraunhofer, AEnergi, SEIC, ENALP, MIS and Develco) and Telecommunications (DEVO and Netplus), jointly possess excellence in skills and requirements needed to drive this ambitious project to successful result. Nevertheless, the competencies of the consortium partners are not exclusively linked to ICT, Energy or Telecom, as they hold multi-disciplinary expertise and capabilities in these sectors.

1.2.2 Project objectives

Objective 1

To define the technical and functional specifications for establishing the overall design of the home energy management system (considered in WP3). The specific objectives are:

- Specification and formulation of requirement specifications for the overall system architecture.
- Specification of Demand Response Infrastructure (home energy management gateway and backbone aggregator infrastructure).
- Specification and design of interfaces.
- Development of a verification and validation plan to be followed during the entire project to ensure that high quality standards are achieved in every development step.

Objective 2

To develop an open ICT infrastructure and architecture for implementation of a Demand Response function in households and also to bring together many services intended for smart grids (considered in WP4). The specific objectives are:

- Development of an open ICT architecture for the deployment and operation of smart grid services and of its key interfaces.
- Development of a generic front-end platform for smart grid services (energy management gateway) based on the OGEMA framework / platform.
- Definition of object models for electrical loads and for relevant smart grid concepts.
- Development of a demand response application (front-end and backend).

Objective 3

To develop the SEMIAH system aggregator intelligence for managing scheduling of selected electrical loads in households (considered in WP5). The specific objectives are:

- Development of aggregation, forecasting and scheduling algorithms capable of managing at least 200,000 households.
- Integration and verification of backend system to ensure 24/7 operation.

- Development of a large-scale simulator to emulate the behaviour of thousands of households.

Objective 4

To integrate the backend and front-end systems, including the infrastructure as needed, and to perform a basic integration test in order to verify that all interfaces are operating as expected (considered in WP6).

Objective 5

Pilot testing and validation of SEMIAH in real end-user environment (considered in WP7). The specific objectives are:

- Testing of SEMIAH in 100 households in NO and 100 in CH to compare different consumer behaviour patterns and electricity supply conditions.
- Assessment of the impact of local production on the stability of the low and medium voltage grid and determine the extent of the observability of this production on different sites in the low voltage grid
- Large-scale simulation of SEMIAH with 200 000 households in order to determine to potential performance of the system and potential large-scale impact.

Objective 6

To ensure that security and privacy issues are effectively built-in in all elements of SEMIAH from the beginning (considered in WP8). The specific objectives are:

- Identify necessary privacy and security requirements to ensure safe and secure operation with only leakage of necessary personally identifiable information, e.g. for billing purposes.
- Ensure that these privacy and security requirements are being designed into the technical solutions from the start.
- Implement the privacy and security objectives and propose supporting security management processes for identifying and mitigating privacy and security risks.
- Verify that the implemented privacy and security controls work as expected in the system demonstrators, and demonstrate being able to detect and mitigate system weaknesses and attacks on the system.

Objective 7

To develop new business models for the implementation of Demand Response in households (considered in WP9). The specific objectives are:

- Identification of the potential for the economical valuation of the flexibility of household loads and the corresponding markets and business partners.
- Estimation of the overall financial benefits based on today and future market prices.
- Development of economically feasible business cases and derivation of appropriate business models.

2 Dissemination

2.1 Dissemination and communication strategy

The consortium behind SEMIAH is committed to ensure that the results of the project are made widely available and accessible to a wide community of users throughout Europe and rest of the world. The dissemination activities ensure efficient communication within the partners of the project as well as with external stakeholders in order to increase awareness about the ongoing project, its results, and the potential benefits and opportunities afforded by the development of the project concepts.

It is a key issue in the dissemination activities to improve the industry's and market confidence in the novel technologies within the scope of SEMIAH. The dissemination and communication tasks are performed as a continuous process during the project and will involve all consortium partners.

It is important that the target audience is taken into account in every communication aspect in order to tailor messages, means, and language.

2.2 Target audience

When designing information channels, tools, and methods, it is important to keep the target audience in view. Therefore, a stakeholder analysis composes the fundament of the dissemination plan.

The most significant stakeholders of SEMIAH at a general level are indicated in Table 1[3].

Table 1: Significant stakeholders.

Stakeholder name	Description
Distribution System Operators (DSO)	The DSO is today the distribution network owner. In the future, the DSO may be a local system operator supporting the role of the TSO through the exploitation of the local flexibility. In order to support the system operation, the DSO will have to purchase necessary flexibility for the operation from large customers, aggregators, and microgrid operators through flexibility markets.
Transmission System Operators (TSO)	The TSO is the transmission system operator on a regional or national level. The TSO is responsible for the overall system operation maintaining the frequency and the real time balance between electricity generation and consumption. Balancing reserves and capacity are purchased in different markets from the other stakeholders.
Prosumers/Customers	Prosumers are consumers that also incorporate any form of DER and flexibility including demand response (DR). Prosumer households will have some sort of production e.g., photovoltaics and/or buffer capacity.
Bulk Producers	Bulk producers are the main energy suppliers in the power grid. Bulk producers can be subdivided into categories renewable energy sources (RES) and non-RES, and further grouped according to production stability, buffer capacity etc.
3rd Party Service	There are different types of Service Providers identified:

[3] The stakeholder analysis is also elaborated in WP3, D3.2 System Requirements and Functional Specifications.

Providers	- energy traders - balance responsible operators - aggregators The **energy traders** are actors in the energy wholesale markets. These markets are slightly different from country to country mainly due to the different levels of regulation (or deregulation). The different marketplaces are divided based on time to delivery e.g. day-ahead market, intraday market etc. The physical balancing and operation of reserve markets are usually linked to the TSO. The **balance responsible operator** is an important role in the wholesale energy market. Obligations made by for instance an electricity provider/retailer to a set of customers must be traded and allocated in the day-ahead market. Price settlement for imbalances between obligations and physical volume is done in the balancing market and involves risk of higher costs. A commercial **aggregator** will operate in the markets as one entity on behalf of several actors. Usually, this is to establish bids above minimum bid-size and to reduce transaction costs. This role may be performed in stand-alone or in partnership with **energy traders**.
Product Developers	Vendors or developers of technology for smart energy control such as home gateways for automation.
Appliance Vendors	Appliance vendors interested in adapting their products to energy control
Telecom Operators	Telecom operators provide telecom services to the residential households. Many telecom operators are looking for ways to bring added value service to their existing customer based. The bundling with energy services is seen as a strong business opportunity for the telecom operators.
Smart Grid Service Developers	Developers of Demand Response (DR) services.
Computer Security Incident Response Team (CSIRT)	This is a team of trusted people (usually formed by Security analysts and coordinated by the Security manager) investigating suspicious security incidents identified by the Security Analysts (see below).
Privacy Ombudsman or Data Controller	This is a person or role in Information Security Management that is responsible for protecting the Personally Identifiable Information (PII).
Risk Analyst	This is a person, role or organisation in Information Security Management that manages and implements the overall risk assessment and management process. This can either be an actor that is external to the organisation, e.g., a third-party security analysis organisation, or within the organisation. The OCTAVE method[4] advocates the use of internal knowhow, as much as possible, to fulfil this role, as they have a significant amount of domain knowledge that should be leveraged in this process.
Security Analyst	This is a person or role in security operations that monitors security incidents for signs of intrusions, and proposes mitigation strategies to identified threats
Security Manager	This is a person or role in Information Security Management responsible for security. Furthermore, the Security Manager is responsible for identifying which security clearance that is required by the other persons or roles.

[4] OCTAVE method http://www.cert.org/resilience/products-services/octave

Apart from the above mentioned significant stakeholders in an overall perspective, the target group for dissemination activities also include the segments mentioned in Table 2.

Table 2: Dissemination target groups.

Dissemination target group:	Description
Potential investors	Business angels or companies that will invest in Smart Grid solutions.
Policy makers	The policy makers have an essential impact on the market penetration of Smart Grid solutions. Regulations can change business cases significantly; hence, politicians and influencers are an important SEMIAH dissemination target group. Also the national and regional authorities as well as energy associations play an important role in this perspective.
General public	The general public will be affected by the deployment of the SEMIAH concept in large scale. Not only will they have to be educated in the grid challenges/opportunities (has to be done in an extremely easily accessible way), their behaviour and energy consumption pattern will also be changed to a certain degree. This is the result of rescheduling and interruption of appliances. Also the choices people make within the fields of heating, cooling, transportation, etc. will be influenced by and/or regulated by different instances, so it is very important to have the general public as co-players.
Scientific community	The SEMIAH project will reveal results that are highly relevant to both researchers and students in scientific communities all over the world.
Relevant industrial sectors	Apart from the industrial segments mentioned in Figure 1, there are also other relevant industrial actors that have an interest in SEMIAH. Among these are meter manufacturers, software developers (user interface providers), system integrators, big data specialists, and alarm companies. Sectors like these will be strongly affected by large-scale rollout of SEMIAH concepts.
Media	Both the popular, scientific, and industrial media are important target audiences in the dissemination activities. They can help spreading knowledge of new technologies and project results.
European Commission	The European Commission plays an inherently important role in SEMIAH by providing the economic basis for the project and constituting a visibility channel towards Europe.

In addition to the segments mentioned in Table 1 and Table 2, there is a very important communication activity to be carried out during the project process, the internal communication. This is further elaborated in section 2.5 ‘Internal communication’.

2.3 Communication tools

The communication tools in the following section are all selected with a view to support the above mentioned target group analysis. The linguistic means in all dissemination activities must be equivalent to the audience group and the level of technical terms and academic depth will therefore vary depending on the occasion and medium.

2.3.1 Logo

A logo for the SEMIAH project aims to help communicating the uniqueness of the project and to express its scope. Furthermore, the SEMIAH logo shall help identifying project activities and help creating an identity for the consortium in this regard.

Figure 1: SEMIAH logo

The SEMIAH logo has been designed to express:

- Connectivity
- Continuity
- Grid
- Globe

The dual coloured lines give the impression of 3D. This underpins the vision of the spinning globe making the Smart Grid business grow by connecting appliances and people all over the world.

2.3.2 Project website

The SEMIAH website was officially launched by 30. April 2014 and will continuously be updated along the whole project. The website constitutes deliverable D1.1 and has been described in a separate report; hence the content details will not be included in this report. Though, the project website is considered a major dissemination tool intended for facilitating the spread of project information and a core element in the external communication which is the reason for mentioning a few key elements below.

The main objectives of the SEMIAH website are to:

- Provide information on the project in general
- Provide information on project activities, updates, and outcomes.
- Offer project partners easy access to public dissemination and deliverables
- Provide contact information

The site consists at this moment of 1 front page and 28 subpages. It can be accessed from the URL: www.semiah.eu.

Aarhus University is the formal owner of the domain name.

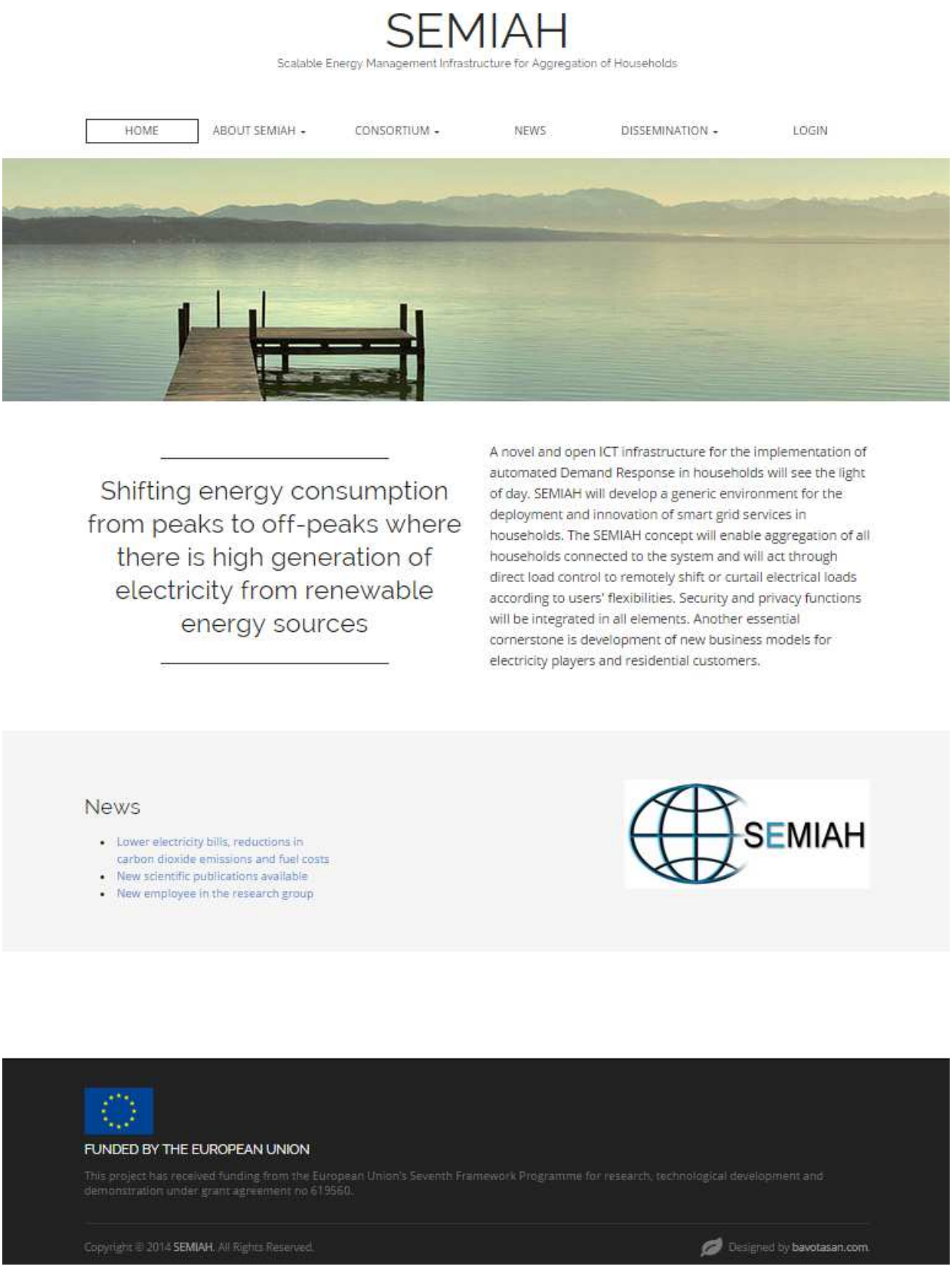

Figure 2: SEMIAH website

Direct links to the website have been created from the beneficiaries' organisation websites. With the aim of increasing the presence and visibility of SEMIAH and its content at the World Wide Web, relevant websites will be asked to refer with a link to the SEMIAH webpage. Increasing the number of links to www.semiah.eu will be a good contribution to the SEO effort affecting the Google ranking positively and lead to a greater online visibility.

Information contained on the project website is likely to be valuable even after the project has finished. Therefore, the consortium aims at ensuring that the website will continue to exist after the project funding has finished, and that bookmarks and published URLs will continue to function.

2.3.2.1.1 Responsive design

The website has a responsive design meaning that the site will scale and adjust automatically to all types and sizes of screens, systems, and browsers. This applies whichever online platform is chosen; computer, tablet, or smartphone. The result is a much better user experience for the viewer and at the same time it only requires updates from one backend for the EDM/website administrator.

Public dissemination from SEMIAH is published through this page. Furthermore, scientific publications are listed and linked to from the page. This way, the page is used as a "Deliverables and Publications" record of all the publications and deliverables with a direct link to SEMIAH project and in particular, the publications obtained within the project.

2.3.2.1.2 Security aspects

In full accordance with the security and privacy aspects of SEMIAH, these have also been applied to the project webpage.

The project has hired a so-called ethical hacker to work on the security testing of the OGEMA software. He also checked the SEMIAH website and found that the platform itself (WordPress installation) is not among the best ones from a security point of view. Though, we recently updated to a new version which solved several vulnerabilities of the old version.

Furthermore, the user enumeration and the ckeditor-for-wordpress plugin along with some other aspects also revealed vulnerability.

In the project, we will consider taking some steps to increase the security of the site and prevent malicious robots from infecting it. This effort will though be balanced with the estimated risk and the available resources.

2.3.2.1.3 Google Analytics

The SEMIAH project uses Google Analytics for providing webpage statistics. Via this tool, the online traffic is being monitored, including:

- Number of sessions, page views, returning visits vs. new visits, number of pages per month, average session duration, and frequency rejection.
- Geographic and demographic data.
- System data (e.g. browser, operating system, and service provider) .
- Mobile Data (e.g. device, browser, screen resolution, etc.).
- Channels.
- Keywords in references.

Figure 3: Website statistics

Figure 4: Website geographical statistics

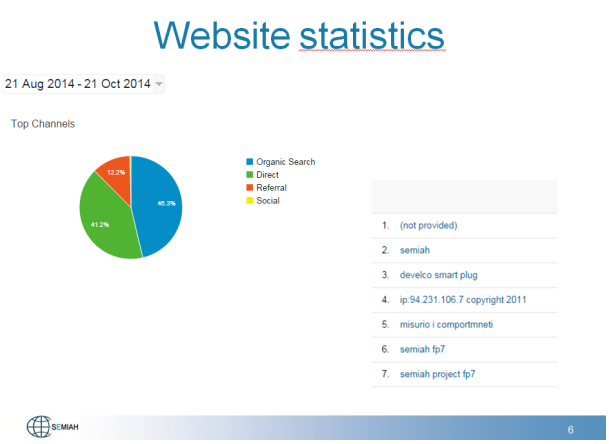

Figure 5: Website platform statistics

2.3.2.1.4 News

News published on the SEMIAH webpage will help stakeholders outside the project to keep up-to-date with the progress of the project and its results. Posting news on the website may also be used to highlight results and publications from outside the project which has direct implications and relevance to SEMIAH.

There are several ways of accessing news posted at the SEMIAH webpage. There is a News tool bar at the bottom of the front page and at minor pages, there are also news in the right side of the window. When reading one novelty, there will be links to other news from SEMIAH.

2.3.3 Project templates

Templates have been developed in order to make the project have an overall visual identity when presenting SEMIAH publicly and internally. This will strengthen the identity and reference to the project. A common design in different formats for SEMIAH project communication has been prepared. Hence, all partners have templates for preparing Power Point and Word documents “the SEMIAH way”.

The logo constitutes an essential part of the SEMIAH recognition which is the reason for making this relatively visible on the templates.

Figure 6: Power Point template.

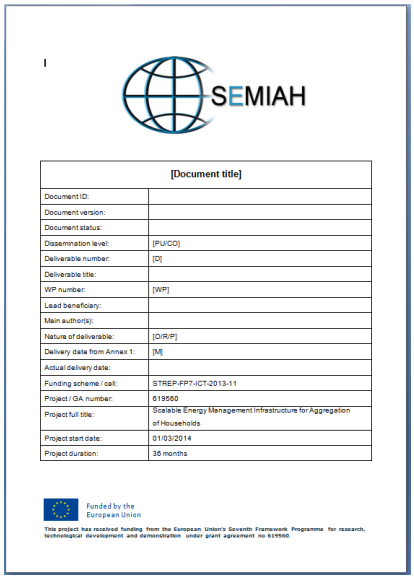

Figure 7: Word template

2.3.4 Promotional material

2.3.4.1.1 Leaflet

A SEMIAH leaflet summarizing the key points of the project will be created. The brochure will have the form of an easily printable version with an attractive layout so that it is easy to distribute and to send out electronically. This also makes us capable of updating it whenever needed.

The purpose of the leaflet is to offer simple and concise information on SEMIAH to the wide audience.

2.3.4.1.2 Posters

Posters are created in the course of the project when needed for conferences, trade fairs, and other events. The purpose is promotion of the project.

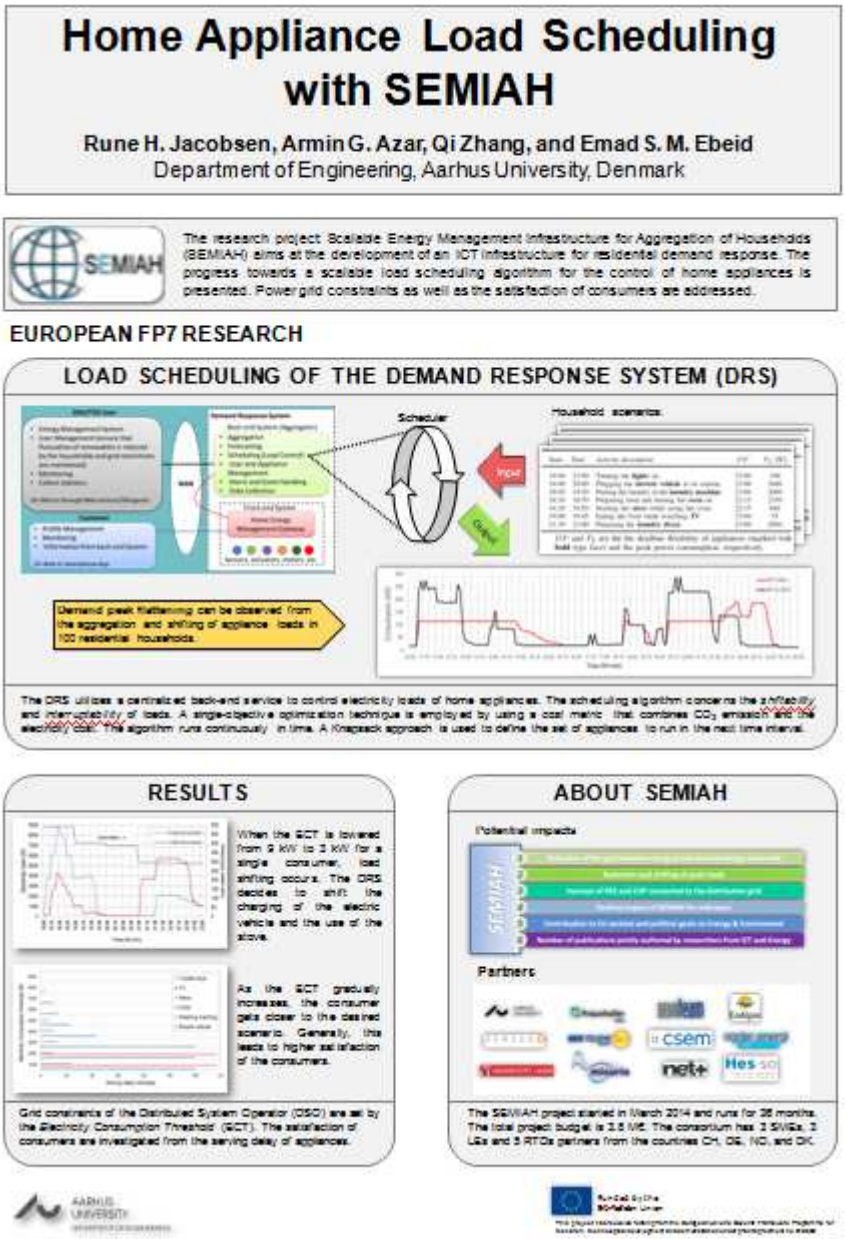

Figure 8: Poster example

2.3.5 Scientific papers

As stated in the project description, dissemination activities will include, inter alia, publication of at least 8 scientific papers jointly authored by researchers from ICT and Energy in peer-reviewed journals.

Scientific papers of the scientific and technological achievements constitute a valuable and significant contribution to the dissemination and exploitation activities of SEMIAH.

Besides increasing the project visibility in the scientific communities related to the project topics, this will stimulate further advancement in related research areas, further collaborations, and interdisciplinary cross-fertilization. In particular, the scientific partners will aim at publishing as many papers as possible on the main research topics on which the project builds, e.g., Smart Grid communication, algorithms for Demand Response, Smart Grid security and privacy, internet and web, wireless networks, software engineering, electrical and control system engineering, computational intelligence, etc.

Below is a list of journals targets for the scientific dissemination in the SEMIAH project.

• AI (Elsevier)
• Applied Energy (Elsevier)
• Computers Standards & Interfaces (Elsevier)
• Future Internet (MDPI)
• IEEE transactions on Power Systems (IEEE)
• JAIR – Journal of Artificial Intelligence Research (AI Access Foundation)
• International Journal of Smart Grid and Clean Energy (ETPub)
• Journal of Energy Engineering (ASCE)
• Smart Grid and Renewable Energy (SCIRP)
• Wireless Personal Communications (Springer)
• IEEE Transaction on Smart Grids (IEEE)

Figure 9: List of scientific journals

The linguistic means in scientific dissemination activities must be equivalent to the audience group and will therefore include various technical terms and in-depth analysis.

2.3.6 Press releases and press conferences

Besides publishing scientific papers, the consortium will also disseminate SEMIAH findings via press releases. As indicated in the stakeholder analysis, the media constitute an important part of the target audience and are considered a vital communication channel for reaching the general public. Elaboration of press releases also aims at attracting media attention to the project in general and thereby raising public awareness of SEMIAH.

Each partner is responsible for producing press releases in their own languages and in other languages when appropriate. All partners may organise specific events for media news dissemination.

A list of press releases is available at http://semiah.eu/press-releases/.

The linguistic means in dissemination activities targeting the general public must be equivalent to the audience group and will therefore be relatively simple and often explaining highly technical terms.

2.3.7 Conferences and trade fairs

The consortium partners will promote SEMIAH at conferences and trade fairs they attend during the project.

We aim at giving presentations at relevant scientific and commercial conferences and industry fairs and events within the fields of interest to the project. Furthermore, we keep a good dialogue with industry and trade organisations.

Relevant conferences/fairs include (but are not limited to):

Table 3: List of conferences and fairs

Conference	**Status**
• AAAI (National Conference on Artificial Intelligence)	Planned for the future
• AAMAS(Agents) (Autonomous Agents & Multi-agent Systems/International Conference on Autonomous Agents)	Planned for the future
• ACM e-Energy (International Conference on Future Energy Systems)	Submission planned in January.
• European Utility Week	Planned participation in 2015 and 2016 SEMIAH is applying for a speaking opportunity
• E-world Energy & Water Exhibition	Considered less important.
• IARIA ENERGY (International Conference on Smart Grids, Green Communications and IT Energy-aware Technologies)	Considered less important.
• IARIA SMART (International Conference on Smart Systems, Devices and Technologies)	Yes, participated in 2015.
• IEEE/WIC/ACM IAT (International Conference on Intelligent Agent Technology)	Planned for the future.
• IEEE ISGT (IEEE PES Conference on Innovative Smart Grid Technologies)	ISGT Europe has been cancelled. Investigating possibility for ISGT North America.
• IEEE ICC (IEEE International Conference on	Yes, participated 2015.

Communications)	
• IEEE CCNC (IEEE Consumer Communications & Networking Conference)	Planned for the future.
• IEEE SMARTGRIDCOMM (IEEE International Conference on Smart Grid Communications)	Planned for the future.
• IJCAI (International Joint Conference on Artificial Intelligence)	Planned for the future.
• International Conference on Applied Computing	Planned for the future.
• International Conference on Future Energy Systems	Considered less important.
• Smart Grids Smart Cities Forum	Considered less important.
• Smart Grid Summit	Considered less important.
• IEEE International Conference on Signal Processing. Informatics. Communication and Energy Systems	Yes, participated in 2015.
• IEEE International Conference on Industrial Informatics.	Yes, participated in 2015.
• IET International Conference on Renewable Power Generation	Yes, participated in 2015.
• IEEE. Advanced Topics in Electrical Engineering	Yes, participated in 2015.
• International Conference on the European Energy Market EEM15	Yes, participated in 2015.
• IEEE POWERENG 2015	Yes, participated in 2015.
• Euromicro Conference on Digital Systems Design (DSD)	Yes, participated in 2014. Organizing a special session on system design for the smart grid with an invited SEMIAH paper.
• ICISSP (First International Conference on Information Systems Security and Privacy)	Yes, participated in 2015.

To support the increase in general knowledge about European Smart Grid technology, the SEMIAH project will investigate the possibility of organizing a workshops or symposia in collaboration with the conference services of the IEEE.

In addition, we are working at the possibility of getting a workshop and potentially an exhibition stand at the European Utility Week to be held in Vienna in November 2015. This would give us the opportunity to showcase project results so far and get some input from the market side. At this time, we are approximately half way in SEMIAH, and it will be good for the consortium to get some external “eyes” on the project scope and progress.

2.3.8 Events

Project results will be presented to a broad audience at Open Days, workshops, and seminars held at the participating universities and research institutions.

In 2015, the SEMIAH project will organize a special session on “System Designs for the Smart Grid” at the DSD2015 conference in Madeira, Portugal.

http://paginas.fe.up.pt/~dsd-seaa-2015/dsd2015/call-for-papers-dsd-2015/sdsg-special-session/

2.3.9 Social media

2.3.9.1.1 LinkedIn

All partners are encouraged to mention SEMIAH at their LinkedIn profiles. This is considered an efficient way of leveraging the project awareness since a large part of the target group and stakeholders in general are present at this platform.

2.3.9.1.2 YouTube

We will consider creating a short promotional trailer for the SEMIAH project. The video will then be published at YouTube and thereby help raising the awareness of the project. Another important aspect of this is also the generation of web traffic and the subsequent improved Search Engine Optimization (SEO).

The promotional trailer can also be used for dissemination events like Open Days and workshops.

An example of a YouTube video resulting from student working with demand response in relation to the SEMIAH project can be found here: https://www.youtube.com/watch?v=789MopOAVek

2.3.10 Product marketing

Commercial partners of SEMIAH will promote their products to come out of the project, directly or indirectly. SEMIAH implicates development of new products and solutions that will contribute to the growth of these companies and their cooperation partners.

The developed products will be marketed by the commercial partners themselves and will stimulate the dissemination of SEMIAH.

2.4 Creating synergies

In the long-run, dissemination of the knowledge gained in SEMIAH will also be carried out by involvement of partners in new research projects – projects funded either by the EU or by

national/regional funds or associations. SEMIAH builds on the knowledge and results gained in other research projects since many of the SEMIAH partners already participate in ongoing projects. Close cooperation with these projects as well as future projects will enable wide-ranging dissemination throughout the stakeholders and wide target groups[5].

The synergy with other research projects is obvious and therefore, SEMIAH is proactively sharing outcomes with other projects. Currently, the cooperation counts (but is not limited to) the following international and national projects:

Table 4: List of related research projects

Project	**Short description**	**Possible synergies**
PRECYSE	Prevention and reaction to cyber-attacks to critical infrastructure. This project has developed a methodology, and architecture and a set of tools to improve, by design, the security of a critical infrastructure. SEMIAH will adapt the security solutions from the PRECYSE project to our Smartgrid based Demand Response system as well as build additional functionality on top of these solutions (for example better methods for access control, anonymisation and intrusion detection for OGEMA).	The SEMIAH project can build upon the security architecture created by the PRECYSE project. This is a general security architecture that demonstrated protecting critical infrastructures and providing increased security awareness in two domains: urban traffic control and SCADA systems for energy utilities. The infrastructure is based on a set of virtual machines that integrate existing security tools, such as the OSSEC host-based intrusion detection system (IDS), Snort network-based IDS, Shorewall firewall and OpenVAS vulerability testing tool. It also uses some new tools, such as the Reversible Anonymiser allowing for building privacy-enhanced XML-based services. These were integrated into a web service based security architecture supported by an enterprise service bus. SEMIAH will benefit from the web service based interfaces developed by the PRECYSE project, which facilitates easier integration of security tools such as intrusion detection systems into the planned web service based architecture of SEMIAH. SEMIAH will also be able to reuse and extend the risk assessment tools, based on the Verinice information security management tool and the PRECYSE developed

[5] Please see the stakeholder analysis in section 2.2 Target audience.

		OpenVAS import filter (arftoverinice) that was integrated as part of the project, as well as using/adapting the MAGERIT based OCIL security compliance test suite developed by the project.
ADDRESS	ADDRESS is a large-scale project for the development of interactive distribution energy networks. It addresses active demand in the context of the smart grids.	The SEMIAH project will build on the knowledge on active demands from the ADDRESS project. The ADDRESS project was terminated in 2013.
ECOGRID	The project is the largest demonstration project for DR in Denmark. It includes a study on the influence of DR on energy markets.	The SEMIAH project can learn about market adaptation and implementation of DR from the ECOGRID project. The ECOGRID project is scheduled to end 2015.
MIRABEL	The main goal of the MIRABEL Project is to develop an approach on a conceptual and an infrastructural level that allows energy distribution companies to balance the available supply of renewable energy sources.	The SEMIAH project can build on the flexibility concepts defined by MIRABEL. The MIRABEL project ended in 2012.
SmartHG	The project addresses smart energy services using a cloud-based infrastructure connecting to HEMS controlling the residential household. Synergies in database handling and HAN networking are expected.	Like the SEMIAH project the SmartHG project uses DEVELCO technology to provide energy services. Synergies are expected from the knowledge gained from the SmartHG pilots. AU is beneficiary of the SmartHG project. The project is scheduled to terminate in 2015.
FINESCE	The project contributes to the development of an open IT-infrastructure to be used to develop and offer new app-based solutions in all fields of the Future Internet related to the energy sector. Synergies in energy services and control technologies are expected.	In the project DEVELCO has developed a ZigBee tunnel for Modbus to control Danfoss inverters. Danfoss divested and there were new production development at DEVELCO. The project provides a set of “generic enablers” and aims at developing a platform where other companies can make apps based-on this. SEMIAH plans to use the market insights from the FINESCE project. Furthermore, the pilots running in DK (Stenderup, Horsens) could be a potential target for a SEMIAH exploitation. SEMIAH plans to meet

		with Insero Software to discuss a possible collaboration.
iPower (DK)	iPower is a strategic platform where universities and industrial partners consolidates innovation and research activities for the purpose of developing intelligent control of decentralized power consumption. Synergies in the development of tools to manage millions of flexible consumption units are possible.	SEMIAH will consider becoming a member of the Danish iPower societal partnership. This will give access to the knowledge base of iPower.
VPP4SGR (DK)	The project assesses the demand response potential of a large residential building. Synergies in control strategies for demand response and VPP design are possible.	The SEMIAH project can use technology from VPP4SGR to compare algorithms, learn about VPP concepts. The possible use of SEMIAH technology in the VPP4SGR test bed will be investigated. Furthermore, the VP4SGR has installed one of the largest ZigBee networks for home automation based on DEVELCO products. The tool for analyzing ZigBee mesh networks deployed in VPP4SGR can be reused in SEMIAH. Both DEVELCO and AU are partners of the VPP4SGR project.
INCAP (DK)	INCAP is a research project about user behaviour in relation to flexible power demand at household level.	Synergies are expected within user needs and acceptance of flexible consumer units. The project studies the potential of providing DR of refrigerators. DEVELCO is supplier of the needed technology. SEMIAH will investigate if we can get the data to analyse the potential of complementing DR of direct heating elements with DR of refrigerators.

Electricity Usage in Smart Village Skarpnes (Norway)	Monitor the production and consumption of electricity in a group of zero energy houses with photovoltaic modules on the roof.	Develop a tool for planning of the electricity grid that models distributed generation and user patterns typical for zero energy houses. Develop new business models that are set for a future situation where passive and zero energy houses with distributed electricity production dominate the residential electricity market. Use the data to analyze and determine the power quality. Some of the houses may also be recruited for the SEMIAH NO pilot. SEMIAH has already used this information in D7.1.

Moreover, the consortium partners are active participants in scientific and commercial networking groups which also compose important dissemination channels.

2.5 Internal communication

Good internal communication among project partners constitutes the basis for the development of fruitful project results. The objective is also to ensure the consortium's ability to exploit the project results through knowledge sharing, documentation, and development.

Therefore, the internal communication is considered an essential part of SEMIAH. All partners must be aware of this. The EDM and the Project Coordinator will together at meetings and other occasions stress the importance of effective and precise internal communication.

Meetings, workshops, and other events are organised at key stages of the project. Please see below the meeting calendar for SEMIAH consortium meetings.

Month no.	Date	Type	Duration	Place	Host
M1	Mar. 2014	Kick-off meeting	2 days	Aarhus, Denmark	AU+DEVELCO
M4	June 2014	Project workshop meeting	2-3 days	Kassel, Germany	FRAUNHOFER
M6	Sep. 2014	Project workshop meeting	2 days	Grimstad/Kristiansand, Norway	DEVO
M12	Feb. 2015	1st Review meeting	2 days	Brussels, Belgium	EC
M18	Aug. 2015	Interim Project workshop	2 days	Neuchatel, Switzerland	CSEM
M24	Feb. 2016	2nd Review meeting	2-3 days	Arendal, Norway	AENERGI
M30	Aug. 2016	Project workshop meeting	2 days	Jura, Switzerland	HES-SO
M36	Feb. 2017	3rd Review meeting	2-3 days	Valais, Switzerland	SEIC/ENALPIN

Figure 10: SEMIAH consortium meeting calendar

In addition to the common meetings, numerous bilateral meetings are to be held amongst participants in each work package. These meetings are organised either as physical face-to-face meetings or via Skype.

Monthly meetings are held amongst the WP leaders which constitute an important part of the coordination and overall planning of the project.

To further support the collaboration and internal communication, the consortium makes use of two online collaboration tools: Wikispaces and FRAUNHOFER's LiveLink server. These tools help optimising the overview of the progress and the documentation handling. We have chosen these tools because they are tailored to exactly the purpose that we need them for and therefore they replace a restricted area at the SEMIAH website (though, they can be accessed via links from the public website).

E-mails constitute another essential tool in the internal communication. They must be used with care in order to reduce the number of e-mails to be sent out (e.g. limiting the number of e-mails sent to the whole consortium when only relevant for specific partners).

2.6 Overview of communication tools, purpose, and partner roles

The table below gives an overview of the communication tools, their purpose, and the roles of the partners.

The target group of the external communication is: DSOs, TSOs, prosumers, bulk producers, 3rd party service providers, product developers, appliance vendors, telecom operators, Smart Grid service providers, potential investors, policy makers, general public, scientific communities, meter manufacturers, alarm companies, user interface providers, system integrators, big data specialists, the press, participants of other research projects, test pilot participants, EC, and project partners[6].

The target group of the internal communications is the project partners.

In the first column, the tools addressed in section 2.3 Communication tools are listed. In the third column, the required effort from the partners is specified.

The second column addresses the purpose of the specific measure. The purpose of an external communication activity can be:

1. Create **awareness** about the challenges and the potential solutions provided by SEMIAH.
2. **Informing** and Table 1the target audience as appropriate.
3. **Engaging** the target audience or parts hereof with the aim to get input/feedback on problems, expectations, products, experiences, etc.
4. **Promoting** the project.

Communication tools	Purpose	Partner role
Externally		
SEMIAH website	Awareness Information Promote SEMIAH and spread knowledge of the project, progress, and	All project partners must provide relevant information and documentation about project progress and outcomes in order to enrich the SEMIAH website and ensure efficient communication. The EDM is administrator of the website and will put

[6] Cf. Table 1and Table 2 in section 2.2 Target audience

Communication tools	Purpose	Partner role
	results.	content from the partners online.
Partner websites	Promotion Awareness Information	Partners must link to the SEMIAH website from their own company/institutional websites.
Press releases	Awareness Information Promotion	Partners must write and send out relevant press releases to announce important achievements in the project.
Leaflet	Awareness Promotion	Partners must print out flyers to be handed out at conferences, trade fairs, and other events. An electronic version shall be circulated electronically and published on the project website.
Posters	Promotion Awareness	Partners must promote the project by adding presenting SEMIAH posters at exhibition stands, seminars, workshops, conferences, etc.
Presentations at conferences, seminars, and other events	Engagement Promotion Information Awareness	Partners must take advantage of every opportunity of presenting SEMIAH at relevant events.
Project templates	Promotion	Partners must use the templates whenever they present the project in order to make SEMIAH have an overall visual identity and strengthen the identity and reference to the project.
Scientific papers	Information Awareness Engagement	Research partners must publish at least 8 scientific papers jointly authored by researchers from ICT and Energy in high-ranking scientific journals.
Trade fairs	Promotion Awareness Information	Partners must take advantage of opportunities to showcase SEMIAH at relevant trade fairs.
Workshops	Engagement	Workshops might be arranged by partners as small interactive events with aim to improve work in progress and eventually get feedback from users of the test sites.
Product marketing	Promotion Awareness	Commercial partners must promote their products to come out of the project.
Social media	Awareness Promotion Information Engagement	Partners must post news and project results at relevant social media.

Communication tools	Purpose	Partner role
Promotional video	Awareness Promotion	Partners must link to the video on YouTube.
Internally		
Wikispaces	Project coordination, information exchange, reporting preparation	Partners must provide relevant information.
FRAUNHOFER LiveLink	Overview of documentation, meeting minutes, project coordination, information exchange	Partners must provide relevant information.
Skype	Ease collaboration by providing access to long-distance meetings without spending resources on travelling.	Participation in Skype meetings.
E-mail	Information exchange and coordination.	Partners must provide relevant information and aim at limiting the number of e-mails to the whole consortium.

Figure 11: Overview of communication tools, purposes, and partner roles.

2.7 Monitoring dissemination activities

In order to keep track of the dissemination carried out, the EDM has elaborated some dissemination logs. They are intended for internal use and are available at the SEMIAH intranet at the FRAUNHOFER platform. Every partner is obliged to fill out the log when a dissemination activity has been carried out. Alternatively, he can inform the EDM and then she will log the action.

There are two different templates for logging dissemination activity; one for scientific publications.


A1 List of scientific publications

No.	Title	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Year of publication	Relevant pages	Permanent identifiers (if available)	Will open access provided this publication?
1										Yes
2										Yes
3										Yes
4										Yes
5										Yes
6										Yes
7										Yes
8										Yes
9										Yes
10										Yes
11										Yes
12										Yes
13										Yes
14										Yes
15										Yes

Figure 12: Dissemination log- Scientific publications

The other one is for keeping track of all other dissemination activities.

A2 List of dissemination activities

No.	Type of activities	Main leader	Title	Date/period	Place	Type of audience	Size of audience	Countries addressed
7	Select	Select				Select		
8	Select	Select				Select		
9	Select	Select				Select		
10	Select	Select				Select		
11	Select	Select				Select		
12	Select	Select				Select		
13	Select	Select				Select		
14	Select	Select				Select		
15	Select	Select				Select		
16	Select	Select				Select		
17	Select	Select				Select		
18	Select	Select				Select		
19	Select	Select				Select		
20	Select	Select				Select		
21	Select	Select				Select		
22	Select	Select				Select		

Figure 13: Dissemination log

The templates both have the options to select the data from the table below.

ValidTypes	DisseminationLevel	OpenAccess	AudienceType	IPType	ExploitableForeground	ConsortiumPartners
Select	PU (Public)	Yes	*Select*	*Select*	*Select*	*Select*
Publication	PP (Restricted to other programme participants)	No	Scientific community (higher education, Research)	Patent	General advancement of knowledge	Aarhus University
Conference	RE (Restricted to a group specified by the consortium)		Industry	Trademark	Commercial exploitation of R&D results	Agder Energi Nett
Workshop	CO (Confidential, only for members of the consortium)		Civil society	Registered design	Exploitation of R&D results via standards	CSEM
Web			Policy makers	Utility model	Exploitation of results through EU policies	Develco Products
Press release			Medias	Other	Exploitation of results through (social) innovation	Devoteam Solutions
Flyer			Everybody			EnAlpin
Article published in the popular press			Other			Fraunhofer
Video						HES-SO
Media briefing						Misurio
Presentation						netplus.ch
Exhibition						SEIC-TELEDIS Group
Thesis						University of Agder
Interview						Consortium
Film						
TV clip						
Poster						
Product marketing						
Other						

Figure 14: Dissemination log options

All scientific publications in peer-reviewed journals are available at http://semiah.eu/publications/

A list of press releases is available at http://semiah.eu/press-releases/

An overview of all public deliverables can be found at http://semiah.eu/public-deliverables/

2.8 Dissemination activities carried out so far

There have been several dissemination activities going on during the first months of the SEMIAH project. The dissemination log counts:

A2 List of dissemination activities

No.	Type of activities	Main leader	Title	Date/period	Place	Type of audience	Countries addressed
1	Web	Develco Products	www.semiah.eu	30-04-2014	World Wide Web	Everybody	Worldwide
2	Press release	Aarhus University	Launch of the SEMIAH Project on Smart Energy Research	07-05-2014	Aarhus, Denmark	Medias	Europe
3	Web	Consortium	Press release launched at partner websites - Launch of the SEMIAH Project on Smart Energy Research	08-05-2014	DK, N, Ch, D	Medias	Europe
4	Article published in the popular press	Aarhus University	Forskere vil ændre europernes energiforbrug / Scientists will change the Europeran energy consumption	11-06-2014	DK	Medias	Denmark
5	Thesis	Agder Energi Nett	Master thesis by M.A.S.T. Ireshika: Home Energy Management System	30-06-2014	Norway	Scientific community (higher education, Research)	Norway
6	Thesis	Aarhus University	Master thesis by M.E. Kobbərø: Undersøgelse af Demand Response strategier implementeret med Smart En	30-06-2014	Denmark	Scientific community (higher education, Research)	Denmark
7	Media briefing	SEIC-TELEDIS Group	Press conference at HEV's in Sion organized by SEIC	14-10-2014	Switzerland	Medias	Switzerland
8	Press release	CSEM	Lower electricity bills, reductions in carbon dioxide emissions and fuel costs	14-10-2014	Switzerland	Everybody	Switzerland
9	Interview	EnAlpin	Interviews at press conference by local tv-station Canal9	14-10-2014	Switzerland	Everybody	Switzerland
10	Interview	EnAlpin	Interview with EnAlpin with the local radiostation RRO in Visp, Switzerland	14-10-2014	Switzerland	Everybody	Switzerland
11	Article published in the popular press	EnAlpin	News on RRO online portal	14-10-2014	Switzerland	Everybody	Switzerland
12	Article published in the popular press	EnAlpin	News on online portal www.1815.ch of local newspaper Walliserbote	14-10-2014	Switzerland	Everybody	Switzerland
13	Article published in the popular press	Misurio	Article in the print newspaper Walliserbote after phone interview with Karl Werlen (MIS) and Fabian S. (EI	14-10-2014	Switzerland	Everybody	Switzerland
14	Article published in the popular press	HES-SO	Votre maison connectée pour une meilleure efficacite energetique	14-10-2014	Switzerland	Everybody	Switzerland
15	Interview	HES-SO	Projet pilote: Optimiser sa production d'energie et baisser le cout	14-10-2014	Switzerland	Everybody	Switzerland
16	Interview	HES-SO	Cinq entites valaisannes participent a un projet européen dans le domaine de l'energie	14-10-2014	Switzerland	Everybody	Switzerland
17	Exhibition	Develco Products	European Utility Week 2014 (EUW14)	06-11-2014	Holland	Industry	Europe
18	Product marketing	Develco Products	Squid.link - flyer + micro website + promotional trailers at YouTube	06-11-2014	Denmark	Industry	Europe
19	Conference	HES-SO	First Scientific Day on Demand Side Response / Management	24-10-2014	Switzerland	Scientific community (higher education, Research)	Europe
20	Article published in the popular press	CSEM	Participation dans un conglomérat européen	12-11-2014	Switzerland	Industry	Switzerland
21	Workshop	Fraunhofer	FRAU and UiA conducted a workshop focusing on IT-Security in Generation of Renewable and Thermal Pow	04-12-2014	Germany	Scientific community (higher education, Research)	Europe
22	Article published in the popular press	SEIC-TELEDIS Group	Place à la consommation intelligente (all customers (customer newsletter) on paper (55'000 contacts) an	26-11-2014	Switzerland	Industry	Europe
23	Article published in the popular press	CSEM	Senkung von Energiekosten, CO2-Emissionen und Brennstoffkosten	14-01-2015	Switzerland	Industry	Europe

Figure 15: List of dissemination activities

Below, some highlights are described.

2.8.1 Press release on the launch of SEMIAH

A press release describing the launch of the project as well as its scope and objectives was sent out by Aarhus University.

2.8.2 Press conference in Switzerland

A press conference at HEV's in Sion, Switzerland was organized by SEIC on 14 October 2014. CSEM wrote a press release regarding the launch of SEMIAH that was widely distributed. Subsequently, at the press conference, the Swiss partners gave interviews to a local tv-station „www.canal9.ch". The interviews were aired 14.10.14

The press conference furthermore resulted in an interview of EnAlpin with the local Radio station „www.rro.ch" in Visp, Switzerland. This was aired 14.10.14 as well.

In addition, SEMIAH was promoted at the following media:

- News on rro online portal „www.rro.ch" 14.10.2014
- News on online portal „www.1815.ch" of local newspaper „Walliserbote" on 14.10.2014
- Article in the print newspaper „Walliserbote" on 15.10.2014 after phone interview with Karl Werlen, Misurio, and Fabian Schmidhalter, EnAlpin.

Figure 16: Highlights from the Swiss press coverage of SEMIAH

2.8.3 Launch of project website

In April, the SEMIAH website was launched. Please see section 2.3.2 Project website for further explanation.

2.8.4 Publication of scientific articles

Three scientific articles have been published during the first period of time.

A1 List of scientific publications

No.	Title	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Year of publication	Relevant pages	Permanent identifiers (if available)	Will open access provided this publication?
	Security and Privacy in the SEMIAH Home Energy									
1	Management System	T. Gjøsæeter	17th Euromicro Conference on Digital Systems	29-08-2014	IEEE	Verona, Italy	2014			No
2	SEMIAH: Scalable Energy Management Infrastruc	R.H. Jacobsen	17th Euromicro Conference on Digital Systems	29-08-2014	IEEE	Verona, Italy	2014			No
3	A Scratch-based Graphical Policy Editor for XACM	Henrik Nergaard, N	ICISSP 2015 - First International Conference on Information Systems Security		ESEO	Angers, France	2015			Yes

Figure 17: Scientific publications during the first period of time

The scientific articles are referenced on the webpage considering copyright issues[7].

[7] http://semiah.eu/publications/

2.8.5 Master's theses

Two master's theses regarding Home Energy Management systems and Demand Response strategies have been released and some of them are in progress.

2.8.6 EUW14

Develco Products participated in the European Utility Week 2014 held in Amsterdam in November 2014[8]. At their exhibition stand, Develco Products presented two posters with regard to SEMIAH, one poster mentioning the project and one poster showcasing the gateway developed in the SEMIAH project. In addition, the both staff was promoting SEMIAH to relevant stakeholders.

2.8.7 Product marketing

Develco Products has started marketing the gateway developed in SEMIAH. The gateway is called Squid.link and has got its own website, www.squid.link.

Furthermore, a brochure has been created to explain technical details about the gateway.

Two promotional trailers have been produced and published at YouTube in order to further increase the brand awareness.

[8] For info on the event, please visit http://www.european-utility-week.com/

3 Exploitation

3.1 Exploitation

In this chapter, the exploitation of SEMIAH project results will be addressed. The early stage of the project makes it difficult to determine the final exploitation potential since this is dependent on the project results that have not yet been put forward. The exploitation section in this report will hence focus on the consortium partner's intended exploitation ideas.

The socioeconomic impact of the generated knowledge and technology to be used for influencing decision makers and the rest of the target audience is closely linked up with the dissemination activities.

The chapter will first bring a short overview of the market succeeded by an exposition of the market penetration barriers for DR. Subsequently, there will be a short summary of the expected impact of the SEMIAH concept and its solutions.

Finally, there will be a description of each partner's exploitation opportunities as seen at this stage of the project.

3.2 The market[9]

The emergence of Smart Grid gives rise to new solutions aiming at improving energy efficiency and reducing peak demand. Demand Response, changes in electricity usage by consumers from their normal consumption patterns in response to price or other signals, is considered one of the essential solutions to obtain the above advantages [1]. Though, no automated DR programs have been implemented for European households despite the fact that households represented approximately 26% of the total energy consumption in Europe in 2012 [2] and were responsible for 10% of the CO_2 emissions in 2007 [3].

DR is still in its nascent stage in Europe with the existing programs essentially targeting large industrial customers (conversely to SEMIAH that will specifically target residential consumers), since they are easier to manage as one large client represents hundreds of households in terms of energy consumption.

According to Frost & Sullivan, the Home and Building Energy Management Systems (HEMS/BEMS) markets face push factors, such as EU Directives that support smart technology in energy monitoring and management, as well as pull factors from the demand side as technology improves and becomes more easily available. Together with rising prices of energy, these two factors will lead the HEMS and BEMS market to double-digit growth over this decade" [4].

The mega-trend, Internet of Things (IoT), will probably refashion the way we live significantly. A report from Goldman Sachs states that IoT is emerging as the third wave in the development of the Internet. The 1990s' fixed Internet wave connected 1 billion users while the 2000s' mobile wave connected another 2 billion. The IoT has the potential to connect 10X as many (28 billion) "things" to the Internet by 2020, ranging from bracelets to cars [5] – electric devices that will all consume power.

Focus is on new products and sources of revenue and new ways to achieve cost efficiencies that can drive sustainable competitive advantages. Goldman Sachs names privacy and security "a likely source of friction on the path to adoption" [5] which is perfectly in tune with the scope of SEMIAH.

[9] Cf. the SEMIAH application, updated with new numbers.

Goldman Sachs further expresses that “The IoT building blocks will come from those that can web-enable devices, provide common platforms on which they can communicate, and develop new applications to capture new users.

> **Enablers**: we see increased share for Wi-Fi, sensors and low-cost microcontrollers.
>
> **Platforms**: focus on software applications for managing communications between devices, middleware, storage, and data analytics.
>
> **Industrials**: Home automation is at the forefront of the early product opportunity, while factory floor optimization may lead the efficiency side” [5].

Apart from adding more and more devices to the overall energy consumption, there is also a tendency in increasing the use of more power consuming devices (electric vehicles, instant water boilers, induction heaters, and heat pumps).

The main customers of the overall SEMIAH concept will thus be DSOs intending to optimise their own grid in order to reduce the investments need for reinforcing the grid where there are bottle-necks and also to handle significant feed-in of renewable energy sources in local areas without compromising the power quality. The “battery capacity” of SEMIAH may also be used by power companies to reduce balancing charges; it may possibly also be traded on the electricity market.

The offered solution covers a Demand/Response service that can match electricity consumption to electricity production better than existing solutions. It aims at providing the prototype of a turnkey solution that covers everything from control hardware and software to be installed in homes, virtual power plants performing aggregation, and to market planning and trading functions. In the SEMIAH consortium, there is no energy trading company included, but since it is not likely that SEMIAH will earn the bulk of its money from trading energy, we do not see this as an impediment.

The final solution also supports security monitoring, which may be outsourced as a separate service.

Last but not least, the individual products developed in the project hold a great market potential.

3.3 Demand Response market barriers

As it appears in the market research in the SEMIAH project description, “the implementation of DR has been strongly inhibited by the following barriers:

1. ***System Cost and Complexity*:**
   The average price for Home Energy Management Systems (HEMS) was approx. €300 in 2011 and is expected to decrease to approximately €230 in 2018 [6]. These prices are often prohibitive and too high for a large uptake of the technology, given the lack of economic incentives offered to the customers to modify their consumption patterns.
   Moreover, these systems are proprietary and do not host a platform for 3rd party applications such as DR. Finally, a single and open platform with access to both communication drivers inside households as well as the outside world is required for the large deployment of smart grids.
2. ***Lack of ICT infrastructure and aggregators*:**
   Aggregation services are fundamental to efficiently balance supply and demand and to ensure that both utility companies as well as customers derive benefits.
   In order to support the large implementation of DR systems, a significant deployment of advanced measurement and control systems is required, including advanced aggregation, forecasting and scheduling components.

The ICT infrastructure must be secure, scalable, distributed, provide time guaranties and support transactional and analytical operations of data.

3. ***Lack of clear business models for DR systems*:**
   Currently, clear business models for DR systems have not been defined yet, particularly due to a lack of methodologies for the quantification of costs and benefits for energy utilities as well as consumers. In fact, the amount of flexibility of single households' appliances is too small for trading transactions of energy and ancillary services. Therefore the suggested aggregation and disaggregation of a huge number of devices is crucial and equally important, tools to estimate the financial benefits are needed. Therefore, significant work is required in this area.

The aforementioned challenges must be overcome to ensure the deployment of technologies to efficiently and securely manage energy consumption in households so as to significantly increase the substitution of conventional generation (fossil fuels-based) with RES and in order to reduce/shift peak loads"[10].

3.4 SEMIAH impact[11]

The consortium behind SEMIAH is focused on developing a unique solution for households where the central aggregator system will simultaneously optimise and manage a large number of partial loads according to the generation of electricity from RES. It is expected that the system will have real-time Demand-Response within less than 5 minutes response time.

The solution consists of:

1. A back-end system, consisting of a central server which manages and controls information from the households connected to the system network, and which provides intelligent services for energy management of the household.
2. A Home Energy Management Gateway to control customers' loads based on the OGEMA framework.
3. A user interface (smartphone application and consumer web portal) that allows the user to configure the settings of household equipment and add/remove equipment to/from the system.

SEMIAH concentrates on software architecture and components, algorithms, service descriptions, and interoperability for an aggregator function and will develop a prototype to be used in the project.

As stated in the project description, the deployment of SEMIAH in 200,000 households would allow the shifting of 90 GWh/year of electrical consumption from fossil fuels to Renewable Energy Sources (RES), thereby reducing the gap between RES produced and consumed.

Moreover, SEMIAH is expected to reduce peak loads by 120 GWh/year.

In addition, the deployment in 200,000 households is expected to generate savings for energy utilities of €5.85M/year and of at least €83.25/year for the consumer.

SEMIAH will hence significantly contribute to EU energy policies and bring benefits to the electricity market (residential customers, energy utilities, and grid operators). More concisely, the impacts count:

1. Reduction of the gap between energy produced and energy consumed.
2. Reduction and shifting of electricity peak loads.

[10] Application pp. 3-4.
[11] Cf. the SEMIAH application.

3. Increase of renewable energy sources and combined heat and power stations connected to the distribution grid.
4. Positive impact on the end-users participating in the SEMIAH project.
5. Contribution to EU's societal and political goals on energy and climate.
6. Increasing the number of publications jointly authored by researchers from ICT and energy sectors.

3.4.1 SEMIAH Key Performance Indicators (KPIs)

In order to quantify the impact of the SEMIAH project, a set of KPIs have been established. KPIs are proposed in a way to ensure that they are relevant and ambitious but also realistic.

Table 5: Initial set of SEMIAH KPIs.

SEMIAH KPI no.	Type of KPI *)	Description
KPI1	Customer	Customer satisfaction. Based on the measurement of the pilot customer satisfaction.
KPI2	Process	Amount of energy shifted. Estimate of the energy shifted based on control actions in the SEMIAH infrastructure during pilot testing
KPI3	Process	Speed of a DR. Measured as the time needed to provide responses of 10 kW, 100 kW, and 1 MW peak demand power reductions.
KPI4	Process	Constraint violations.
KPI5	Economical	Possible electricity price saving. Since differentiated prices cannot be controlled in SEMIAH this will be based on experiments using electricity market price triggers of DR.
KPI6	Economical	Front-end system cost. Reference configuration to be defined.
KPI7	Knowledge	Number of peer-reviewed scientific publications
KPI8	Knowledge	Number of dissemination events attended to by representatives for the SEMIAH project
KPI9	Knowledge	Number of visitors on the SEMIAH web page.
KPI10	Knowledge	Number of master and PhD students graduating from thesis project involving SEMIAH.

*) KPIs can be either customer-, process/technical, economical, or knowledge-oriented

3.5 Partner exploitation

3.5.1 Aarhus University (AU)

Knowledge and know-how developed by AU in the SEMIAH will be exploited for teaching and research purposes. Furthermore, industrial exploitation as spin-off will be pursued.

3.5.1.1 Exploitation in Teaching

AU will use the knowledge gained in SEMIAH project to provide input for new graduate courses and student projects in Smart Grids. In particular, SEMIAH will support student's project involving Demand Response technology. As an example SEMIAH, provides a good foundation for use case

studies in existing courses such as the graduate course: "Wireless IP and Internet of Things (TIIPWI)" and the course "Systems Engineering (TISYE1).". For the former course on hands-on exercise has already been developed (see Figure 18: Demand Response student's exercise in TIIPWI course.).

Wireless IP and Internet of Things (TIIPWI)

Exercise 1: Load shifting in the Internet of Energy

November 7, 2014

Contents

Exercise 1 will concern a smart grid application that makes use of forecast data from the Internet to schedule electricity load.
Allocated time for the exercise is: 1 hour and15 minutes.

1 Electricity load shifting in the Internet of Energy

In the future, the Internet of Things will be used to continuously collect information about electricity usage of appliances or more generally: distributed energy resources (DER) in the power grid. This information will be used to provide knowledge about the status and balance between electricity supply and demand. Moreover, the information can be used to ease the integration of renewable energy sources (RES) such as wind and solar generation, that are characterized with a high degree of volatile electricity production. The use of ICT to provide an infomation exchange to improve and stabilize the power grid infrastructure is commonly refered to as the smart grid by the power engineering society or the internet of energy by the internet society.

Electricity consumption is a consequence of daily activities of people. In this exercise, you will demonstrate the shifting of electricity load of a residential user based on CO_2 emission data and electricity price information from external information providers on the Internet. The aim is to develop the backend logic of a demand response provider for a residential household. The backend service shall be implemented as a web service in the cloud. The key functionality of the backend is:

- Collect forecast data from information providers.
- Present and virualize forecast data.
- Take, as input, a schedule for the electricity consumption of a residential user based on his/her planned daily activities.

1/4

Figure 18: Demand Response student's exercise in TIIPWI course.

There is currently one PhD student from AU working on the SEMIAH project. In addition, a group of two master students is preparing their master thesis study based demand response technology.

PhD students and master students within Smart Grid communications research at AU forms a cluster of knowledge in which these students from Smart Grid projects, both with national and EU funding, meet daily to inspire, share knowledge, and to support each other. Examples of concrete project include the project: VPP4SGR – Virtual Power Plants for Smart Grid Ready Buildings and Customers, financed by the Danish Ministry for Energy, Climate and buildings, SmartHG – Energy Demand Aware Open Services for Smart Grid Intelligent Automation (EU FP7), and the READY - Resource Efficient cities implementing ADvanced smart citY solutions (EU FP7). These projects are running with participation from AU department of engineering.

These activities should contribute to an improvement of teaching quality and strengthening of academic positions.

3.5.1.2 Exploitation in Future Research and Possible Spin-Offs

AU intends to exploit the SEMIAH results into a set of prototypes, open source software, and platforms as well as software services for residential demand response programs. These elements will be leveraged for additional scientific and technological disciplines within the existing and future smart grid customer/partner base of AU.

AU will investigate the possibility of offering novel and efficient aggregation and scheduling algorithms for the public by using open source software license. Furthermore, a possible hosted backend solution for an SEMIAH backend could be exploited as spin-off for an Aggregator acting in the smart grid.

These activities should contribute to strengthening of academic positions and development of new software products as well as strengthening of the collaboration with industry in EU.

3.5.2 Develco Products (DEVELCO)

3.5.2.1 The Gateway

A huge exploitation area in SEMIAH for Develco Products is to overcome barrier 37 described in the section about Demand Response market barriers, System Cost and Complexity. As previously stated, the average price for a Home Energy Management Systems was approx. €300 in 2011 and is expected to decrease to approximately €230 in 2018 [6].

Develco Products aims – thanks to SEMIAH - at having a multiprotocol gateway that can penetrate the market due to a very competitive price of approximately €60. The final price is fully dependent on the configuration, the number of wireless protocols, and the quantity. This also means that in large quantities, the gateway in the very basic version will be available at €30 which is an extremely competitive price.

One of the essential means to make prices like this come true is the fact that the SEMIAH hardware is an upgraded version of an existing gateway. The development of the product does hence not start from scratch and much effort and many resources have already been spent on this task.

Another very important factor is the production of large quantities. Develco Products will aim at compiling production orders that will make the production price per unit much lower than if the orders were executed separately.

Still under the above mentioned circumstances, we must be aware of - and accept - the fact that it will take several years to pay off the investment of the gateway development in order obtain the low prices.

Though, the market potential as we see it is huge. As stated in the market barrier description, the existing DR systems are “proprietary and do not host a platform for 3rd party applications such as DR. Finally, a single and open platform with access to both communication drivers inside households as well as the outside world is required for the large deployment of smart grids”[12].

The gateway developed in SEMIAH is not at all proprietary. In the contrary, it is a multiprotocol gateway based on open standards. The gateway constitutes an extremely flexible platform for

[12] Cf. section 3.3 Demand Response market barriers.

control of any wireless network. Thanks to the many possibilities that are opened up by the multiple protocols and the different levels of security, the gateway has the opportunity to penetrate more links in the value chain.

Another essential point is the possibility of entering new related markets such as health care, alarm services, access control, etc. The gateway is positioned in the heart of the Home Area Network and constitutes thereby a vital part of the Internet of Things development[13].

3.5.2.2 Squid.link Brand

In accordance with the dissemination activity within the field of Product marketing[14], Develco Products has already started marketing the gateway.

We named in Squid.link and have created a separate website for the products, www.squid.link.

Develco Products has elaborated a flyer with a more technical description and in addition produced two promotional trailers about the product. The videos have been published at YouTube.

The gateway was promoted intensively at the European Utility Week 2014 event in Amsterdam where we took the opportunity of promoting the SEMIAH project in general as well.

3.5.2.3 Develco Products' SEMIAH Exploitation

An exploitation area of huge interest for us is the trial test in partnership with utilities and research organisations as well as service oriented stakeholders who potentially could be customers of Develco Products. We will this way get valuable insight in their thinking and help us learn how we can benefit to their businesses the optimum way.

SEMIAH brings about synergy with several other research projects. Develco Products participates actively in national and international research projects focusing on Smart Grid. We participate in FINESCE, INCAP, iPower, SmartHG, and VPP4SGR. Through these projects, we get access to the newest knowledge from pilot tests and project results/experience within the fields of Smart Grid and Demand Response - knowledge that will also benefit SEMIAH.

Besides all the activities directly performed in SEMIAH, Develco Products also considers SEMIAH as an important channel of visibility. Furthermore, it provides the possibility of testing future products and configuration set-ups. The SEMIAH project results will become an integral part of Develco Products' market understanding and will - together with input from customers and SEMIAH stakeholders - compose the basis for decision on which products to develop and bring to market in the future.

Our product portfolio is widely based on the open wireless standard, ZigBee. The pilots in Norway and Switzerland will, besides direct project related information, provide valuable insight in the consumer's behaviour and thinking of our products as well as feedback on the intelligent energy services. The strong element in this case is the widespread rollout of ZigBee smart meters. Nearly half of Denmark is covered with ZigBee ready meters and many countries are right now rolling out the same type.

If we in SEMIAH can show that the required massive investment in grid capacity can be reduced by deploying a more intelligent way of using the energy infrastructure, then this will have a remarkable effect on the business of our company – not only in Denmark but in Europe as a whole.

[13] Cf. the market analysis and IoT description in section 3.2 The market.
[14] See section 2.3.10 Product marketing.

3.5.3 MISURIO AG (MIS)

Misurio AG is currently launching its own VPP. Thus, there are close relations between Misurio's daily business and SEMIAH. In addition, Misurio is participating in other research activities with a similar scope. Being involved in all these related projects should bring about many synergies which will be helpful for Misurio itself but also for SEMIAH. Those synergies will facilitate certain decisions and allow thinking out of the SEMIAH framework.

As a commercial organization, Misurio hopes to gain valuable insights and findings from SEMIAH which can be adopted to its products and business models. However, that conditions that the outcomes must be close to the market and customer-oriented. For that purpose, Misurio tries in WP 9 to bring in a market perspective and assess the developed models and approaches.

If there is a marketable result of the project, Misurio is willing to put that product on the market and enhance it in cooperation with other project members. It is Misurio's interest to contribute to a project which is not just filed at the end of the project period.

3.5.4 netplus.ch SA (NETPLUS)

netplus is actively looking for new customer services in the area of home automation, energy management, health, and security management to be deployed towards our residential customer base.

Ideally, the results of SEMIAH project would be provided as an option to our Triple-play package. We envision including it in our premium package.

Even if not directly available in an applicable commercial form, the SEMIAH results will help netplus to:

- Gain competencies in the Home Energy Management field.
- Gather customer feedback to iterate the product through targeted enhancement.
- Elevate customer awareness of our new active role in home automation and energy management.
- Work closely with the local DSOs.
- Provide a differentiator to the local DSOs to help them get a competitive advantage in a liberalised market.

3.5.5 Universitetet i Agder (UiA)

3.5.5.1 UiA Exploitation

The main exploitation for UiA will be to use the knowledge gained in the SEMIAH project in future national or EU projects within energy, health or security. The knowledge gained on OGEMA can for example have synergies with UIA's existing research on eHealth systems and smart homes for elderly people. This knowledge will also be used in future teaching and master projects, in order to transfer and disseminate knowledge about the SEMIAH system. UiA may consider commercialising parts of SEMIAH using its Technology Transfer Office in collaboration with Coventure AS.

The solution from the work package on privacy and security will be released as Open Source software, so that other parties can exploit this software commercially. Privacy-enhanced network monitoring is considered a niche market which would need to compete with larger commercial actors with bigger market share, but technically inferior solutions.

Providing an Open Source solution is one way to ensure that the impact of the solutions is as large as possible. Managed security service providers who see privacy enhanced operation as a market opportunity could then use our tools to implement such services. The same goes for the OGEMA based security monitoring solution, which could be a possible new product for managed security service operators. Providing the foundations of such services as an Open Source product will allow managed security service providers to build and provide supplementary security monitoring services on top of the SEMIAH and OGEMA infrastructure. This allows for outsourcing security operations from the Demand Response provider, which will provide a more efficient service than running it in-house due to the networking effect and experience of managed security service providers.

The privacy-enhanced operations should make it possible to outsource such services from a privacy and security perspective. Additional services that may be built on top of the SEMIAH security services, is alarm services for homes. This would probably be most interesting for traditional security guarding companies. In eHealth, the energy management gateway can in the future be extended to be used for smart home automation as well as for implementing services for assisting elderly people, for example in emergency situations. One concrete example is supporting services like fall alarms. The privacy-enhancing infrastructure of SEMIAH would be useful for such health-related services.

UiA plans to submit 4 conference papers and 2 journal articles per year related to Smart Grid (Demand Response), Security and Privacy. We also plan to have 3 MSc theses per year related to SEMIAH. Towards the end of the project, UiA aims at having at least two newspaper articles about the project.

UiA plans to use SEMIAH research outputs in teaching of under graduate & post graduate courses:

(i) Smart Grid, ENE 502, 5 ECTS, (post graduate course)
(ii) Power Electronics for Renewable Energy, ENE 402, 10 ECTS, (post graduate course)
(iii) Grid Integration of Renewable Energy Systems, ENE 229, 10 ECTS, (under graduate course)
(iv) Specialization Project, IKT 508, 10 ECTS (Master course)

Expert lecture at IEEE ICIAFS 2014 pre-conference workshop on Advances in Sustainable Engineering System, University of Ruhuna, Sri Lanka on 'home energy management system for non-critical power intensive domestic loads' Dec 2014,

Relevant privacy and security conferences and journals that will be considered can be found at IEEE Cipher's Calendar of Events: http://www.ieee-security.org/Calendar/cipher-hypercalendar.html. UIA aims at publishing in at least one high-profiled Security and Privacy conference or journal.

3.5.6 FRAUNHOFER IWES (FRAUNHOFER)

Since the FRAUNHOFER is an Institute of applied research regarding dissemination the overall objective is to transfer the accumulated know how of the project towards its application. Solutions that will be developed within the project could lead to products and will be explained in more detail below.

One of the project objectives is to develop new methods e.g. probabilistic forecasts and algorithms for demand response with uncertainty. It is planned to integrate these methods in existing forecasting systems, systems for household scheduling based on improved stochastic optimization and demand response.

Each of the described solutions could lead by itself later to an own product which could be used in different application areas. Nevertheless the goal is more to interconnect different ideas and

technologies based on excellent research in order to combine them later into a joint solution that will be adapted according to the different customer needs.

WP9 concepts for analyzing security of Smart Grid Technologies will be developed, adopted and evaluated. These concepts will help to build up secure software products for smart grid and smart market application on the one hand. On the other hand, the concepts and results of the security evaluation are needed for possible consultants of our customers.

3.5.7 CENTRE SUISSE D'ELECTRONIQUE ET DE MICROTECHNIQUE SA (CSEM)

CSEM is a private, nonprofit company for applied research focused on generating value for a sustainable world. CSEM's mission is to provide novel applications and solutions to its customers, to enhance industries' competitiveness.

Therefore, CSEM main exploitation plans will be the transfer of knowledge acquired during the SEMIAH project to industry, to promote the application of demand-response solutions and smart grids.

In particular, CSEM will focus on the development of low-voltage networks model and control algorithms, which could be used by energy solutions providers to insure network stability.

Moreover, CSEM will investigate the possibility of developing new models for consumers' behavior and provide forecasts for the energy demand. These algorithms could then be integrated in a demand response system or in district or grids solutions for energy management.

Finally, CSEM will give its contribution to dissemination through the participation to scientific conferences and journal papers writing. As an example, a poster has been submitted to the annual SCCER conference and a conference paper has been submitted to IEEE IES POWERENG15.

3.5.8 HAUTE ECOLE SPECIALISEE DE SUISSE OCCIDENTALE (HES-SO)

HES-SO being a university of applied sciences, the first impact of the SEMIAH project will be on education. The results and experience acquired will be integrated in the courses at the bachelor and master level, especially in the Smart Grid domain. Moreover, multiple student projects (bachelor and master) will be focused on SEMIAH. Post grade courses will also be modified to integrate SEMIAH's results.

In addition to education, participation to workshop and conference, as well as 2-5 articles published are planned, to disseminate the collected experiences and to have to possibility to discuss about this project and get criticized.

Finally, this project will allow to pursue our applied research in this field and to continue to work with electricity related companies and other SMEs.

3.5.9 DEVOTEAM SOLUTIONS AS (DEVO)

DEVO intends to offer solutions and/or services based on the result from the SEMIAH project. This might be commercialisation of the SEMIAH software.

DEVO will exploit results from SEMIAH in the following ways:

- Gain competence, experience, and references to strengthen our advisory services within Smart Grid, integration and processes and methodology.

- Build competence and experience with DR solutions.
- Build relations with leading players within the Smart Grid area.
- Develop services and solutions during the project which can be commercialised for DEVO.
- DEVO will assess the possibility of taking in the role as the aggregator during the pilot phase.

3.5.10 AGDER ENERGI NETT AS (AEnergi)

Our goal with the SEMIAH project is mainly to gain experience with demand side management (DSM) as a regulation tool. A challenging electrical infrastructure and the use of more power demanding equipment, motivates to develop a system for peak shaving. Such a system can potentially prevent overloading of lines, cables and transformers during high load conditions, and be cost effective when compared to grid reinforcement. Also, installation of unregulated Distributed Generation (DG) increases, partly due to governmental support. Demand response in combination with DG helps maintaining the balance in the electrical power system.

Sirdal, our chosen pilot area, is a winter resort with the largest activity during the public holiday, often on very cold days. Consequently, there are a few hours a year with excessive loading of grid components, a challenging situation which can be solved with DSM.

For DSM to be adaptable, a sufficient amount of regulation capacity needs to be available at each household. An important outcome during the project period is therefore an overview of this data for each house, on a daily as well as on a seasonal basis.

Insight in customer behavior is also an interesting objective. If the system is to be scaled up and commercialized, customer attitude is highly relevant. It is important that the solution does not compromise customer comfort and the equipment is aesthetically pleasing.

If DSM proves to be easily implemented in the households, the customers are positive to the implementation and there is enough regulation capacity available, a desirable outcome is a functioning capacity market for demand response. From our point of view, the solution is only sustainable if it makes financial sense, meaning that it must profitable compared to grid reinforcement.

3.5.11 SEIC-TELEDIS (SEIC)

Our goals within the SEMIAH project are divided in 3 aspects regarding our different domains of activity:

- As an electricity supplier, we want to gain experience in smart-home technology in order to manage the main thermal loads of our customers and shift them in time (demand side management). On one hand, the customer should find an advantage with a dynamic pricing of his electricity consumption and in his capacity to remote control his heater or boiler with a smartphone for instance. On the other hand, a customer with photovoltaic panels could optimize his consumption to consume as much as possible when the sun is shining. We are also investigating the introduction of smart-home solutions into our telecommunication triple play package with our partner NETPLUS, which is also a partner of the SEMIAH project.
- As a DSO, we want to reduce our grid costs by shaving our consumption peak.
- As an energy supplier, we are also exploring the possibility to reduce our correction costs (difference with forecasts), to sell energy at pic time on the market, or to sell flexibility to the grid regulator.
- SEMIAH should provide us with the best business model encompassing a mix of the 3 points mentioned above.

3.5.12 En Alpin (EnAlp)

The goal of EnAlpin within the SEMIAH Project is mainly to gain experience in the following activities:

- As an energy trader we want to learn about the possibility to sell not only energy at peak price times, but also being able to offer capacity or flexibility to the grid regulator, coming from aggregated households in the appearance of a virtual power plant.

- Having the possibility of flexible loads in our distribution grid as a DSO, we want to use the possibility to reduce our costs from the upper tension levels by shaving our local grid consumption peaks.

- As an energy supplier, we want to create and offer attractive, dynamic pricing models for our clients, who may save money by offering us the possibility to steer their flexible loads. This may result in a high customer loyalty to EnAlpin as energy supplier.

3.6 Joint exploitation

This section concerns the exploitation of the SEMIAH concepts and technologies. It outlines the strategy to develop business plans and address potential SEMIAH.

3.6.1 The SEMIAH value proposition

The market participation of aggregated flexible resources is subject to much on-going research. The use of flexibility resources for e.g., system balancing, grid optimizations, market balancing, or energy market participation will present a number of impacts and drive new interactions between existing (and new) actors which could be coordinated in a number of ways within a given market.

Overall, SEMIAH address the flexibility operator who is a general role that pools the small flexibilities of customers / network users (e.g. from CEMs) in order to make use of them in the grid or on energy markets. Although the basic concept of the flexibility operator seems to be widely accepted, the name and the detailed tasks of the flexibility operator are varying [1]. According to the description of the role concept in [1], the generic actor “flexibility operator” might be carried out by existing market roles like energy suppliers with variable prices, aggregators, Virtual Power Plant (VPP), energy servicing company, agent, etc. Following an assessment of the DR use cases, a number of generic actor groups have become clear [1]. Typical generic actors and market roles mentioned in the use cases provided include:

- Aggregator,
- Market place Energy supplier,
- Agent (e.g., billing agent),
- Balancing Responsible Party (BRP),
- Balancing Group Coordinator (BGC),
- Distribution System Operator (DSO),
- Transmission System Operator (TSO).

The above roles are further clarified in [8].

To concretely define the landscape of potential customers of SEMIAH, the project will identify actors within the above categories for the four SEMIAH partner’s countries, i.e., Norway, Switzerland, Germany, and Denmark. This will result in a database of potential customers.

The types of value creating offer by SEMIAH may differ between different actors. SEMIAH will provide a value proposition design addressing the general flexibility operator. A planned workshop will address the process of the value creating design.

New business model development is dealt with in WP9 of the SEMIAH project. Since dissemination and exploitation planning need to run in parallel in the SEMIAH project a close collaboration between WP2 and WP9 is needed. The business model is a tool that explains how business organizations generate revenues. A more formal definition of a business model follows from [10]: “The business model is an abstract representation of an organization, be it conceptual, textual, and/or graphical, of all core interrelated architectural, co-operational, and financial arrangements designed and developed by an organization presently and in the future, as well as all core products and/or services the organization offers, or will offer, based on these arrangements that are needed to achieve its strategic goals and objectives.”

Since new business models are under development in WP9 we will deal with the more concrete method of a business case to support the value propositions targeting different flexibility operators. In contrast to the business model, the business case captures the reasoning for initiating a project or task addressing a specific business need. It is often presented in a well-structured written document and/or a calculation to demonstrate a possible future return of investment. The logic of the business case is that, whenever resources such as money or effort are consumed, they should be in support of a specific business need.

To support the SEMIAH value proposition for the different flexibility operator actors a set of initial business cases have been identified. These business cases serve to strengthen the value proposition when potential SEMIAH customers are addressed as part of the project exploitation. A first set of identified business cases is given in Table 6.

Table 6: First set of business cases.

Business case tag name	**Target customers**	**Business logic description**	**Comments**
Savings on grid reinforcements	DSOs	The DSO can postpone investments in distribution grid reinforcements by using SEMIAH technology to reduce peak load demands.	See Sec. 3.6.1.1 below.
The SEMIAH buyer union	Electricity market traders	Members of a “SEMIAH service provider” may form a buyer union to purchase electricity at favorable prices.	To be worked out in D2.3.
Consumer electricity price reduction	End-users	The consumer receives an economic benefit by using SEMIAH technology to shift electricity consumption from periods with high electricity prices to periods with low electricity prices.	This assumes an electricity markets with differentiated prices. Large consumers e.g., >100 kWh/year, have the opportunity to make such agreements with electricity providers in most countries.

3.6.1.1 Business case example: Savings in distribution grid cost due to DR

Figure 19 shows an example of a case study of the possible delayed investment in the distribution grid for a DSO of similar size an AEnergi. It is assumed that the grid investments can be delayed 3 years when applying DR by extended the lifetimes of LV distribution cables and substations. To put his into perspective, AEnergi uses a depreciation time horizon of 25 years for distribution substation and auxiliary systems [12] and the cable lifetime is typically longer [11].

For an approximate number of LV grid customers the number of citizen the Arendal (41655) is multiplied by a factor of 2/5 households per citizen. The cost of new cables (material cost) and the excavation cost are taken from an earlier study in the Stockholm area [11]. Cable costs vary between material choice and cable dimensions. Different cable dimensions are used in different parts of the distribution grid. From [11] the average cable cost is estimated to lie in the range of 70 SEK/meter to 220 SEK/meter. Excavation is more costly in urban areas than rural areas; and it depends on whether roads, bike/pedestrian paths, or grass land need to be restored after cable placement. Excavation costs in the range 55 SEK/meter to 6000 SEK/meter [11] with the highest price being for a city centre. As a final cost input the cost of a substation including a MV/LV transformer is estimated to be around 800 kNOK (2017 prices) based on [11]. Similar cost figures exist at AEnergi. However, these are considered to be confidential.

Parameters for a Nowegian DSO										
Number of LV customers	16.662									
Distribution grid cable meters	221.951	meters	Average cable-meters			13,3	meter/customer			
LV substations	200		Grid reinforcement cost per meter			4.220	NOK/meter			
Cable cost (per meter)	220	NOK	Substation savings (value of ext. lifetime of 3 y			1.152	NOK/customer			
Excavation cost (per meter)	4.000	NOK	Possible delay of grid reinforcement			3	years			
Cost of capital	8,00%									
		2017	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Customer uptake		1,0%	7,3%	13,7%	20,0%	20,0%	20,0%	20,0%	20,0%
Number of SEMIAH customers		167	1.222	2.277	3.332	3.332	3.332	3.332	3.332
Number of "SEMIAH cable meters"		2.220	16.276	30.333	44.390	44.390	44.390	44.390	44.390
Success rate for peak reduction		1,0%	1,0%	1,0%	1,0%	1,0%	1,0%	1,0%	1,0%
Revenue	Per unit								
Saving potential (NOK)	57.366	95.583	700.944	1.306.305	1.911.666	1.816.082	1.210.722	605.361	0
Value added services (NOK)	20	3.332	24.438	45.543	66.648	66.648	66.648	66.648	66.648
SUBTOTAL		98.916	725.382	1.351.848	1.978.314	1.882.730	1.277.370	672.009	66.648
One-off items									
SEMIAH System License (NOK)	-1.000.000	-1.000.000							
System installation (NOK)	-500.000	-500.000							
SUBTOTAL		-1.500.000	-	-	-	-	-	-	-
OPEX	Unit price								
SEMIAH support & maintenance (NOK/system)	-400.000	-400.000	-400.000	-400.000	-400.000	-400.000	-400.000	-400.000	-400.000
Customer support (NOK/customer)	-14	-2.333	-17.106	-31.880	-46.654	-46.654	-46.654	-46.654	-46.654
System maintenance (NOK/system)	-100.000	-100.000	-100.000	-100.000	-100.000	-100.000	-100.000	-100.000	-100.000
SUBTOTAL		-502.333	-517.106	-531.880	-546.654	-546.654	-546.654	-546.654	-546.654
EBIT		-1.903.417	208.275	819.968	1.431.660	1.336.077	730.716	125.355	-480.006
Interest		-152.273	0	0	0	0	0	0	-38.400
Earnings (NOK)		**-2.055.690**	**208.275**	**819.968**	**1.431.660**	**1.336.077**	**730.716**	**125.355**	**-518.406**
Net Present Value (NPV)		1.141.227							
Net Present Value (NPV) per customer (NOK)		68							

Figure 19: Business case example.

At this point in time the business models for SEMIAH is not completed cf. ongoing work in WP9. Hence, a standard license model for digital products has been used. A single-site license of 1 000 000 NOK plus a yearly support and maintenance cost of 400 000 NOK for SEMIAH is used. This price-level is not agreed at this point. On top of this, 500 000 NOK needs to be spent as a one-time cost for system installation. The DSO further incurs an ongoing cost for system maintenance and customer support of 100 000 NOK/year and 14 NOK/customer/year, respectively. On the other hand, extra, although small, revenue of 20 NOK/customer/year is expected from value-added services to be provided which is assumed to be made possible through the installed SEMIAH equipment.

Our case study is based on a DSO with 16 662 customers and 221 951 meters of LV distribution cables. It has an installed base of 200 LV substations including transformers. The DSO is assumed to have a cost of capital of 8,0%. Inflation is not taken into account. Furthermore, it is assumed that any overloading problems in the LV distribution grid are only in few percent of the grid installations and that the SEMIAH is only partly successful in shifting the peak demand to avoid these overload situations. In summary, the model uses a success rate of 1,0% for SEMIAH peak load demand shifting. This number could e.g., correspond to a situation where the DSO has problems in 5% of the LV grid and is able to recruit 20% of the customers (approximately 800 households in the first year) in this part. Finally, the number of SEMIAH customers is assumed to increase from 1.0% of the customer base in 2017 to 20% in 2020, where we assume the level to sustain.

Based on this simple business case, the DSO can profit from a SEMIAH investment by gaining 141 kNOK (net present value) or 68 NOK/customer installations. Using simple tools like the one presented in Figure 19, it is expected that the value propositions of SEMIAH can be strengthen and provides a good opportunity to customize the offering to the needs of customer businesses.

The simple business case will be used in the SEMIAH exploitation as a tool for explaining the value proposition to DSOs.

3.6.2 Identification of Exploitable Assets

An assessment of the possible exploitable foreground was made during the exploitation and dissemination workshop in Aarhus 1 July 2015. Table 7 lists the identified possible exploitable foreground including an assessment of the TRL expected at the end of the project.

Table 7: Possible exploitable foreground.

Short name	**Type of exploitable foreground *)**	**Description of exploitable foreground**	**TRL assessment**
IWES.vpp as a service	2: Commercial exploitation of R&D results.	The VPP component IWES.vpp can be offered as a software service	5-6
Risk assessment tool/method	1: General advancement of knowledge	The security and privacy tools provide new methods to assess the risk in smart grid operations	4
Anonymiser/deanonymiser	1: General advancement of knowledge	The XCAML editor-vispe	4
Managed security services	2: Commercial exploitation of R&D results.	Managed security services for homes/SEMIAH/VPP/GW (extended to alarm services)/platform for security services	4
OGEMA consultancy	2: Commercial exploitation of R&D results.	Consultancy services developed around the OGEMA open source software component	6-7
GridSim consultancy	2: Commercial exploitation of R&D	Consultancy services developed around the	4-5

	results.	OGEMA open source software component	
SEMIAH intelligence	2: Commercial exploitation of R&D results.	The SEMIAH scheduling algorithms can be offered as a software service or be offered as an open source software component. In the latter case, a consultancy business case may be built	4
SEMIAH middleware component(s)	2: Commercial exploitation of R&D results.	This is a key software component that connects a VPP with a set of residential households. The software may be offered as licensed software	5-6
Squid-link home energy management gateway	2: Commercial exploitation of R&D results.	Hardware, software product from DEVELCO. This multiprotocol gateway may be offered as part of the existing DEVELCO product portfolio.	8-9
Telecom value-added services for smart grid	2: Commercial exploitation of R&D results.	Existing broadband access customers of NETPLUS may be offered SEMIAH services as a value-add to an internet access subscription.	5-6
Software amendments for the market model for the economical evaluation	1: General advancement of knowledge	Results from the SEMIAH project may strengthen the EnergyOn platform which is commercially offered by MIS.	6-7
Business case tools	1: General advancement of knowledge	Business tools such as spread sheet to evaluate the potential of DR.	4-5
The “real” data from pilots for research database	1: General advancement of knowledge	The data from the SEMIAH pilots can be offered for research purpose to improve the understanding of the potential of DR technology.	4
Aggregator service provider	2: Commercial exploitation of R&D results.	A spin-off of the SEMIAH aggregator role continues the operator of the DR program using the pilot customers as initial customer base.	6-7

*) Type of foreground: 1: General advancement of knowledge. 2: Commercial exploitation of R&D results. 3: Exploitation of R&D results via standards. 4: exploitation of results through EU policies. 5: exploitation of results through (social) innovation.

For the aggregator service provisioning the plan is to cluster around specific geographical areas where a subset of beneficiaries exploit the SEMIAH infrastructure for a commercial DR project launch. Smart village Skarpnes would likely be used as pilot and hence a starting point for the DR program. In such cluster, DEVO could assume the role of the aggregator, AEnergi the DSO, and with the support from UiA. DEVELCO and FRAUNHOFER are key technology providers.

A similar setup for Switzerland will be planned. The establishment of aggregator clusters is furthermore described in D2.3: “Exploitation plan”.

3.6.3 Preliminary Roadmap for SEMIAH Exploitation

Figure 1 lists planned project activities leading up to a joint exploitation. The plan, including post-project exploitation, will be further elaborated in D2.3: “Exploitation plan”.

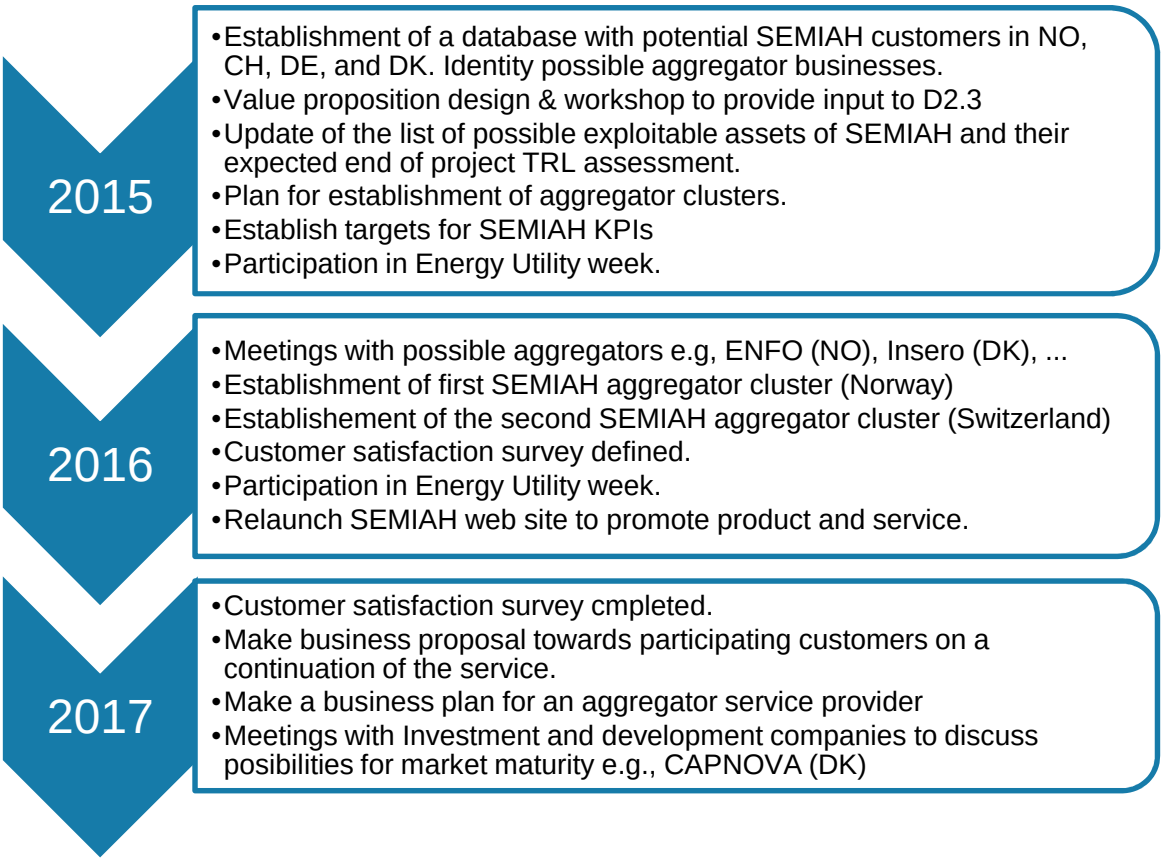

Figure 1: SEMIAH Exploitation Roadmap – A first draft

Overall, the approach is to clarify the value proposition of SEMIAH and to identify possible customers that could benefit from the exploitable assets cf. Table 7. An updated market analysis and competitor’s analysis will be addressed in D2.3: “Exploitation plan”. We will try to meeting with potential customers in the four countries where SEMIAH partners resides to discuss our value propositions and to get feedback. Towards, the end of the project SEMIAH will approach Investment and development companies to discuss possible funding of a market maturity.

The European Utility Week (http://www.european-utility-week.com/) has been identified as the prime strategic conference and exhibition. Potential customers of SEMIAH are expected to join this

event. Presently, SEMIAH is applying for a speaking slot at the strategic conference. Last year, the SEMIAH partners DEVELCO and MIS were present at the event.

4 Conclusion and Next Steps

A dissemination and communication strategy has been elaborated. The target audience has been identified and includes i.e. DSOs, TSOs, prosumers, bulk producers, 3rd party service providers, product developers, appliance vendors, telecom operators, Smart Grid service providers, potential investors, policy makers, general public, scientific communities, meter manufacturers and other industrial segments, the press, participants of other research projects, test pilot participants, and the European Commission.

The best ways to reach the target groups have been appointed. Appropriate tools include i.e. project website, scientific publications, press releases, conferences, trade fairs, promotional materials, and product marketing.

Optimisation of the internal communication amongst consortium partners has been addressed and the synergies with other European research projects are likely.

There has been set up suitable methods for monitoring the dissemination activities and highlights from the dissemination carried out so far have been presented.

During the rest of the project, the appointed tools will be utilised and the plan executed in order to enable widespread publication of the SEMIAH project results.

In the second part of the report, the exploitation opportunities of SEMIAH project results have been addressed. The worldwide challenges regarding climate and energy constitute an enormous market potential for the SEMIAH concept. The SEMIAH consortium is committed to commercialise the solutions developed in the project, since the consortium has a vested interest in minimizing the time to market to recoup their respective investments and begin profiting from the project.

Though, there are also market penetration barriers that must be overcome. The report furthermore describes the expected impact of the SEMIAH concept and its solutions.

Each partner has described its exploitation opportunities as seen at this stage of the project. The D2.3 Plan for exploitation, due on month 24, will include further elaboration on the partner's exploitation of project outcomes. Hence, appropriate measures have been defined to ensure the consortium's ability to exploit the project results.

In this way, the plan for dissemination and exploitation has concluded on the assessment of the best possible ways to disseminate and exploit project results to have the desired impact of the project.

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6 Change History

Revision	Date	Responsible	Comment
1.0	2015-03-23	Dorthe Gårdbo-Pedersen	First version. Submitted for 1RP.
2.0	2015-07-10	Rune Hylsberg Jacobsen	Updated based on the comments from the Technical Assessment after 1RP. The updates are summarized as: - Table 3 provides now information on possible synergies with the identified projects. - Table 4 is updated with a clarification on the target events and which ones have been already attended in the period under review and which ones the consortium plans to attend in the future. - A set of KPIs have been added in Sec. 3.4.1, Table 5. - Section 3.6 describes initial plans for joint exploitation.