MIRACLE

Micro-Request-Based Aggregation, Forecasting and Scheduling of Energy Demand, Supply and Distribution

Specific Targeted Research Project: 248195

D7.3 Dissemination and exploitation plan

Work package – 7

Leading partner: SAP AG

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1 Summary

This document describes the strategy and instruments to be used for disseminating and exploiting results obtained in the MIRACLE project.

2 Dissemination plan

2.1 Overview and objectives

The MIRACLE project's goal is to design and develop an energy data management system that allows to efficiently manage higher amounts of renewable energy and balance support and demand using flexibilities in supply and demand which has been specified by small and medium prosumers (*pro*ducers and con*sumers*) such as households or SMEs.
Dissemination is the communication of project-relevant information to the target groups specified in section 2.2 using the instruments described in section 2.3.
The dissemination activities of the partners in the MIRACLE projects are aimed to the following goals:

- Let the actors in the energy market discover the potential and technology of the MIRACLE energy data management system,
- Influence the standardization activities in the area of demand side management with the development of a concrete standard in this area
- Mobilize interest within research communities for the developed technologies and link the fractionized techniques to the MIRACLE energy data management system as a whole.
- Align with other approaches and projects and use synergies.

These goals are the common base for all dissemination activities in the MIRACLE project.

2.2 Target groups

The main target groups of the project's dissemination activities are

- Decision makers in companies in the energy sector especially utility companies in their role of a balance responsible party
- IT professionals and managers in companies in the energy sector,
- Standardization bodies,
- Participants on the energy market, and
- Researchers/academia focusing on data-intensive systems and the energy sector.
- Influencers / Press

2.3 Dissemination instruments

To communicate intermediate results to the target groups, the MIRACLE project will use different dissemination instruments. We have created a dedicated project design that differs from the corporate design of the individual project partners.

2.3.1 Website

The Miracle website is accessible via http://www.miracle-project.eu. It contains general information about the project, the consortium and summaries of deliverables and other publications.

2.3.2 Industrial events

Industrial events cover industrial workshops and industrial fairs.
Industrial workshops are usually focused on a specific subject and a target audience. These workshops are usually planned on short terms. Therefore, the participation at these workshops can in most cases not be planned.

On industrial trade fairs new technologies and solutions are presented and demonstrated to a broad audience. The project team aims at being present at the following fairs

- SAP external and internal events like International SAP Utilities Conference, SAP SAPPHIRE
- PLATTS
- SYNERGY
- Energyforum
- Spintelligent
- Smart Electric News

Industrial events attended or planned so far are:

- Symposium „Novel solutions of the information and communication technology as the backbone of Smart Distribution", Darmstadt, Congress Center 12th -14th April 2011

2.3.3 Academic events

The partners in the MIRACLE project will be actively participating in ICT oriented and energy related conferences and workshops. The Table below gives an overview of conferences and workshops in the different areas and specifies whether participation is planned. A complete list of ICT related conferences and journals in the area of data and information management can be found at http://academic.research.microsoft.com/CSDirectory/conf_category_18.htm and http://www.informatik.uni-trier.de/~ley/db/.
Many of these events are annually, therefore we target to be present there at 2011 and 2012. Furthermore, opportunities are also identified dynamically e.g. via spread Call-for-Papers and ongoing interactions with other projects or colleagues.

Category	Conference/workshop	Status/plan
ICT oriented	ACM SIGMOD International Conference on Management of Data	
	VLDB International Conference on Very Large Databases	
	IEEE ICDE International Conference on Data Engineering	
	EDBT International Conference on Extending Database Technology	
	DaWaK International Conference on Data Warehousing and Knowledge Discovery	
	ACM DOLAP International Workshop on Data Warehousing and OLAP	
	IEEE CEC, World Congress on Computational Intelligence	
	GECCO, The Genetic and Evolutionary Computation Conference	
	PPSN, International Conference on Parallel Problem Solving From Nature	

	BTW GI-Fachtagung Datenbanksysteme für Business, Technologie und Web	Paper has been accepted for BTW 2011
	SSDBM International conference on scientific and statistical database management	Paper will be submitted in January 2011
Energy related	ETSO	
	CIGRE International Council on Large Electric	
	CIRED International Conference on Electricity Distribution	
	EURELECTRIC	
	IRED Conference on Integration of Renewable Energy Sources	
	IAEE European Conference Energy, Policies and Technologies for sustainable economies	Paper is published
	PIES (Slovenian Energy Information Communication Technology Consultation)	

We plan to or have participated at the following academic events:

- Berthold et al: Exploiting renewable by request based balancing energy demand and supply; Proc. of the 11th IAEE European Conference, August 25-18, 2010, http://www.iaee2010.org/?q=node/83
- Ulrike Fischer, Matthias Boehm, Wolfgang Lehner: Offline Design Tuning for Hierarchies of Forecast Models; Appears In: Proceedings der GI-Fachtagung für Datenbanksysteme in Business, Technology und Web (BTW 2011, Feb 28 – Mar 4 2011, Kaiserslautern, Germany), 2011.
- Lars Dannecker, Matthias Böhm, Wolfgang Lehner, Gregor Hackenbroich: Forecasting Evolving Time Series of Energy Demand and Supply, Submission planned
- Lars Dannecker, Robert Schulze, Matthias Böhm, Wolfgang Lehner: Maintenance Strategies for Forecast Models over Evolving Time Series, Submission planned

2.3.4 Cooperation with other projects and initiatives

MIRACLE will cooperate with other projects in the smart grid area namely MEREGIO, SmartHouse/SmartGrid, DLC-VIT4iP, NOBEL. An overview about related projects is given in deliverable D6.1 “Report on current systems”.
So far, we have participated or plan to participate in the following cooperation activities:

- Presentation of MIRACLE project at the consortium meeting of the DLC-VIT4IP project on November 23rd, 2010
- Presentation of the MIRACLE project at the consortium meeting of the NOBEL project in March 2011
- Call with ECN, a partner in the SmartHouse/SmartGrid project about the PowerMatcher technology in January 2011
- Presentations and discussion on data models and standardisation of information exchange with building energy management systems at a workshop organised by the ICT4E2B Forum project on January 24th, 2011.

2.3.5 Cooperation with standardization organizations

In terms of standardisation institutions/bodies we plan to organize a CEN/CENELEC Workshop agreement and discuss our approach within an ETSI workshop.
So far, we have participated or plan to participate in the following activities:

- Contribution to the Joint CEN/CENELEC Working Group document on a roadmap for Standardisation of Smart Grids.
- Cooperation with ENTSO-E/ebIX on current Harmonized Role Model and possible extensions to this standardized role model for TSOs.
- Investigate the possibilities to set the MIRACLE specifications as ENTSO-E/ebIX pre-standard specifications.

2.3.6 Journals and other publication channels

Publications in scientific journals usually require some detailed research results. They can be expected from the second half of the project's runtime onwards. Especially in the testing phase of the components and the integrated prototype, quantitative results are available that are worth publishing in journal papers. The following journals are planned as a channel for presenting MIRACLE results:

- ACM Transactions on Database Systems
- IEEE Transactions on Knowledge and Data Engineering
- VLDB Journal
- Information Systems
- Data and Knowledge Engineering
- ACM Computing Survey
- IEEE Transactions on Power Systems,
- International Journal of Distributed Energy Resources
- European Journal of Operational Research
- Applied Soft Computing
- Journal of Scheduling
- SAP external channels like sap.info

Currently we have submitted articles or plan to submit articles to the journals:

- Lars Dannecker, Matthias Böhm, Ulrike Fischer, Frank Rosenthal, Wolfgang Lehner, Gregor Hackenbroich: A Survey of Forecast Models for Energy Demand and Supply, ACM Computing Survey; submission planned

2.3.7 Other dissemination material

SAP has designed a project logo and a Powerpoint template. In the shared repository we have past presentation which can be adapted for specific dissemination activities. Posters with a project overview and the first results in terms of the overall concept and architecture will be created beginning of 2011. Video materials will be created in preparation of fairs.

2.4 Implementation strategy and timeline

The dissemination responsible accounts for the communication on the project and its results, both to the internal audience, the scientific community and the potential business users of the outcomes of the project.

Hence all partners are aware of and committed to a proper communication of the project results. It is the principle of all dissemination activities to use research results to create value within the targeted communities of the European Union, and for the partners to promote and ensure a leading edge for themselves within the global market place.

Wherever possible, research results will be communicated for the external awareness creation and knowledge building within the targeted user and scientific communities of the European Union. The communication should guide and prepare potential users for the benefits and potential of the expected outcome of the

MIRACLE project. In order for the dissemination to be effective, an integrated approach will be necessary, combining templates, guidelines and approval processes on one side with a communication platform, publication, event participation and release plans on the other.
Considering the timetable of the project, first significant results are to be expected after the individual components are implemented and testes so from mid of 2011 onwards. Thus, the major part of the dissemination events will start in 2011, although some publications and project materials such as the website have already been created and presented. Once the empirical results of the project are collected and new insights have been gained, a more detailed message can be addressed to the target groups, enhancing the effectiveness of communication.

3 Exploitation plan

3.1 Exploitation Principles and Methodology

Exploitation is recognized as the key enabler for the success of the MIRACLE project.
All partners are aware of and committed to the exploitation of project results. It is the principle of all exploitation activities to use our research results to create value for all participants and to improve their competitive advantages.
The exploitation plan comprises (1) an integrated exploitation approach that combines expertise from product and solution managers; test users amongst the consortium partners and the identification of trial cases serving as validation points are integral parts of our exploitation approach, and (2) partner-specific exploitation plans.
Considering the nature of project partners, commercial and non-commercial exploitation is distinguished. Commercial exploitation aims at transferring research results into new products and services. Non-commercial exploitation is mostly carried out by universities and aims at increasing visibility of research results, identifying resulting open research questions, and improving teaching standards.

3.2 Integrated exploitation approach

The following table summarizes the exploitable knowledge respectively the exploitable results that are generated in the MIRACLE project. A brief description of each result can be found in the table below. We will reference these key results in the following sections when describing the individual exploitation plans and achievements of each partner. With all partners working from a common knowledge and result base, we ensure that all MIRACLE exploitation activities follow a common vision.

Exploitable Knowledge	Exploitable Products or Measures	Sectors of Application	Owners and other partners involved
(1)Energy market in different European countries and ETSO role model	Discussion with standardization organizations in the energy domain and contributions to their documents	Partner internal; Standardization organizations in the energy domain especially CEN	All partners
(2)Concept of demand side management with	Discussion with standardization organizations in the	Partner internal; Standardization organizations in the	All partners

flex-offers	energy domain and contributions to their documents	energy domain especially CEN	
(3)Forecasting of demand and supply of renewable energy sources (RES)	Application for partner specific use cases	Partner internal; Utility companies; RES producing companies	TUD, SAP
(4)Price setting in the energy market and negotiation procedures	Develop business cases for the EDMS developed within the project	Partner internal; Utility companies	SAP
(5)Efficient processing of mass data	Performance analysis	Partner internal;	SAP, TUD, AAU
(6)Distributed, hierarchical prototype system	Proof-of-concept	Partner internal; Utility companies	All partners
(7)Scheduling of energy demand and supply	Application for partner specific use cases	Partner internal; Utility companies	JSI

Table 1: Exploitable knowledge and results

MIRACLE's integrated exploitation approach will be accompanied by certain supportive activities, similar to the dissemination efforts:

- Monitoring of the market and the energy domain throughout the project
- Transfer of research results into the partners' development, product, and service units
- Continuous analysis of transfer opportunities, adjusting the project when necessary in order to ensure the best possible outcome
- Investigation into possible economic benefits and impact of the expected research results
- Continuous evaluation of the advancement of the research results against the user requirements/needs throughout the project (and adjustments when necessary)

3.3 Exploitation of Industrial Partners

Exploitation for industrial partners is primarily focussed on productization and commercialisation of research results. Therefore the existing market will be evaluated and monitored throughout the project and business opportunities for either enhancing an existing business or establishing a new one will be identified.

The partners involved in MIRACLE would then start a transfer into the respective product groups. With this step each industrial partner starts to exploit any relevant innovation by defining technology transfer projects in cooperation with their internal product groups. The goal of these projects is to bridge the gap between the research world and product world. This step can include the creation of a prototype or pilot implementation, a market evaluation, cooperation with potential customers, application for patents and many more. The result will be new or significantly improved products and services. This step aims at enhancing an existing product or defining a fully new product for the market.

Another important aspect for industrial partners lies in increasing product sales. The partners aim at gaining knowledge in MIRACLE research that is instrumental to enable the participating companies to sell innovative products that meet the existing or future needs of the customer base and increase sales and revenue.

3.3.1 SAP

3.3.1.1 Partner profile

SAP is the world's leading provider of business software, offering applications and services that enable companies of all sizes and in more than 25 industries to become best-run businesses. As the global technology research unit of SAP, SAP Research significantly contributes to SAP's product portfolio and extends SAP's leading position by identifying and shaping emerging IT trends.

3.3.1.2 Business model

The business model of SAP Research is based on co-innovation through collaborative research with leading universities, partners, customers, and SAP product groups. SAP Research is committed to develop promising ideas and prototypes for future markets and to turn them into market-ready software for maximum customer value.

3.3.1.3 Exploitation strategy

Miracle results will be transferred to the unit who is responsible for software products for utility companies. The goal is to transfer gained knowledge to the further development of the current products and the development of product portfolio for utility companies.

3.3.1.4 Identification and description of business/transfer opportunities

We have identified the following business/transfer opportunities

Opportunity 1: Gain knowledge about the energy market in different European countries, the ETSO role model and demand side management

- Value proposition: Gained knowledge can help to tailor, extend and improve current products for utility companies
- Value creation: Knowledge transfer into the unit responsible for software products for utility companies
- Revenue expectation: not directly measurable

Opportunity 2: Integrate sophisticated, automatic-configurable, near real-time forecasting capabilities into software solutions for utility companies

- Value proposition: New business opportunities for utility companies because (1) near real-time forecasting leads to good estimations on a short time horizon and (2) automatic-configurable forecasting approach can be easily applied to related data sets such as single customers and groups of customers
- Value creation: Knowledge transfer into the unit responsible for software products for utility companies
- Revenue expectation: not directly measurable

Opportunity 3: Gain knowledge about the performance of data-intensive operations in a distributed, hierarchical system

- Value proposition: Gained knowledge can help to improve current solutions with data-intensive operations
- Value creation: Knowledge transfer into the unit responsible for software products for utility companies
- Revenue expectation: not directly measurable

3.3.1.5 Corresponding marker overview/SWOT analysis

Strengths	**Weaknesses**
Extend knowledge in a the domain of	Data management solution is tailored to

energy market/utility companies Provide data management solutions for selected problems (forecasting, analysis on mass data)	the energy domain; no direct applicability to other domains
Opportunities Becoming experts for demand side management/energy market and for forecasting of time series within the company**.**	**Threats** The knowledge/expertise might be built up in parallel in the unit responsible for the software for utilities. Forecasting functionalities could be developed as part of other projects.

3.3.1.6 Exploitation activities

We have two types of exploitation activities: knowledge transfer and technology transfer projects. The entries in Table 1 can be assigned to the two types of exploitation activities as follows:
Knowledge transfer: 1,2,4
Technology transfer projects: 3,5,6

3.3.2 EnBW

3.3.2.1 Partner profile

With some five million customers, EnBW Energy Baden-Württemberg AG (EnBW) with its headquarters in Karlsruhe is the third largest energy company in Germany. In 2009, EnBW generated annual sales of approx. € 15,700 million with around 20,000 employees. Our core activities focus on the segments electricity, gas as well as energy and environmental services.

3.3.2.2 Business model

The business model of EnBW Research and Innovation is based on co-innovation through collaborative research with leading universities, institutes, industry and customers. EnBW Research and Innovation is mainly carrying out demonstration projects for the PoC of new technologies and processes. This is done in close cooperation with our operative business units.

3.3.2.3 Exploitation strategy

MIRACLE results will be transferred to the unit who is responsible for market processes. The goal is to transfer gained knowledge of the aggregation of distributed generation or consumption and to integrate this aggregated values into the energy trading business.

3.3.2.4 Identification and description of business/transfer opportunities

Opportunity 1: Integrate sophisticated, automatic-configurable, near real-time forecasting capabilities into energy trading and forecasting

- Value proposition: New business opportunities for utility companies because (1) near real-time forecasting leads to good estimations on a short time horizon and (2) automatic-configurable forecasting approach can be easily applied to related data sets such as single customers and groups of customers
- Value creation: Knowledge transfer into the unit responsible for energy trading, forecasting and dispatching
- Revenue expectation: not directly measurable

3.3.2.5 Corresponding marker overview/SWOT analysis

Strengths	**Weaknesses**
Improve knowledge of aggregation of distributed generation and energy consumption/ Use data management solutions for selected problems (forecasting, analysis on mass data)	The applicability of demand side management and aggregation might be over estimated
Opportunities	**Threats**
Becoming experts for demand side management/energy market and for forecasting of time series within the company**.**	The knowledge/expertise is built up in other branches/industries than utilities which might become competitors.

3.3.2.6 Exploitation activities

We have two types of exploitation activities: knowledge transfer and technology transfer projects. The entries in Table 1 can be assigned to the two types of exploitation activities as follows:
Knowledge transfer: 2,4
Technology transfer projects: 3,5,6

3.3.3 INEA

3.3.3.1 Partner profile

INEA is the leading Slovenian company in the fields of industrial energy management, process information and automatization technology.

3.3.3.2 Business model

The goal of the business model is to ensure the advanced and high quality products and solutions for our customers. Following this goal, INEA cooperates with partners on different areas generally grouped into

- Supplier partnership
- Key customers
- Research institutions

Cooperation activities with institutions and development groups cover several types of relationships such as mixed-team development cooperation, technology networks, competence centers, consortia, etc.

3.3.3.3 Exploitation strategy

The exploitation strategy will anchor the following main directions:

- Use developed technologies in enhancing existing solutions and systems for the actors on the energy market: demand side management
    - KIBERnet system
    - Servis TSO system
- Develop, implement and exploit new concrete solutions for actors on the grid
    - for LDE's
    - microgrids
- Develop communication equipment for connecting internal energy management systems with development of Miracle-based communication protocol

- introduce Miracle technology as standard in energy grid of Slovenia, and other countries with strategic partners (Mitsubishi)
- join in exploitation consortium if formed for further development and exploitation of the Miracle technology in European grids
    - pilot projects for proof of concept deployment of technology aimed at gaining experience for further improvements
    - demonstration projects for contained larger scale testing and maturing

3.3.3.4 Identification and description of business/transfer opportunities

The following exploitation/transfer opportunities have been identified:
- Exploitation / transfer opportunity #1: Micro-grid implementation.
- Exploitation / transfer opportunity #2: BRP implementation
- Exploitation / transfer opportunity #3: System service implementation

Opportunity 1: Micro-grid implementation
We have identified the following potential benefits:

- Value proposition: complete functionality implemented in contained micro-environment
- Value creation: all the main actors (roles) are involved: prosumers, producers, consumers, the BRP. Controlled communication with the surrounding main Electricity market system make possible laboratory-like control of relationships. Win-Win-win models can be studied and implemented; EUE and RES subsidies can be obtained from the respective governments, for this purpose. Several micro-grid pilot projects are envisaged, each one carrying the technology development one step further; to this goal, project both in Europe and other areas are possible and envisaged.
- Revenue expectation: INEA targets the revenue for development and sufficient revenue for further deployment of the technology.

Opportunity 2: BRP implementation
We have identified the following potential benefits:

- Value proposition: introduce the Miracle flex technology to an up-start BRP or a BRP in transition from the old integrated position (DSO or equivalent) to the new BRP position. Complete portfolio of partners of a BRP will be involved: industrial prosumers and household prosumers.
- Value creation: Contained field demonstration projects will create benefit for all the involved actors, based on Miracle win-win flex-technology. A number of demonstration projects both in Europe and in other regions are envisaged. Local/regional support through RES and EUE support is envisaged to the projects.
- Revenue expectation: INEA targets the revenue for development and sufficient revenue for further deployment of the technology.

Opportunity 3: Use of the DSM system for different system services

- Value proposition: The business opportunity uses the advanced DSM system to support to system operator at the reliability and security of the network with additional system service

- Value creation: Transfer of the knowledge and technology into the product
- Revenue expectation: Not directly measurement. It should be seen through cost/investment structure of the SO for upgrading the grid, providing new sources, etc.

3.3.3.5 Corresponding marker overview/SWOT analysis

Strengths	**Weaknesses**
The bases of the harmonized role model gives the necessary strength and legality to the project solution.	Unique approach with introduction of closed contracts on the prosumer level requires regulation change and installation of the advanced equipment at prosumer, what moves the project realization in the real environment quite far in the future.
Opportunities	**Threats**
Knowledge of the DMS area and integration of the RES and DER in the EE system gives the strong reference for expertise on smart grid area.	Global energy (electricity) price shall be too low to support the RES. Other solutions with less complex realization will despite higher cost become more attractive for the investors (difficult to find a proper partner for the realization).

3.3.3.6 Exploitation activities

We have two types of exploitation activities: knowledge transfer and technology transfer projects. The entries in Table 1 can be assigned to the two types of exploitation activities as follows:
Knowledge transfer: 1,2
Technology transfer projects: 6

3.3.4 TNO

3.3.4.1 Partner profile

TNO is the largest applied research institute in The Netherlands. It combines around 4000 researchers in various domains, among others also ICT for Energy. In this domain, TNO has extensive knowledge about ICT architectures and information exchange between organizations in the entire network of smart grids.

3.3.4.2 Business model

The business model of TNO is to apply knowledge from fundamental research institutes to societal domains. This is done by building up applied knowledge of the various expertise and develop consultancy around this knowledge. Thereby, TNO provides this knowledge and consultancy to large organization but also to SMEs.

3.3.4.3 Exploitation strategy

The main exploitation strategy is to bring the knowledge that is build up to large Dutch energy companies, to small innovative energy companies and to IT companies that provide IT systems that handle demand and supply of energy. In order to achieve this, TNO maintains contact with the main stakeholders in the energy market, to give them opportunities to review the MIRACLE specifications and get their input on needs and points of view on the flex-offer of energy.

3.3.4.4 Identification and description of business/transfer opportunities

We have identified the following business/transfer opportunities
Opportunity 1: Transfer knowledge about the market of flexible energy demand and supply at national as well as European scale to large energy companies

- Value proposition: the knowledge transfer on the energy market gives large energy companies the benefit that they get insight into new functionalities of existing or new roles in the energy market on dealing with flexible demand and supply of energy.
- Value creation: the value created for these companies is that they can prepare for this market and can select for a certain role to take.
- Revenue expectation: for TNO this might lead to some consultancy projects for a few large Dutch energy companies and new consortium cooperations in which the flexible demand/supply market is further developed.

Opportunity 2: Provide support for the implementation of the data model and message interface specification in the business software of energy companies, albeit self-implemented software systems or systems from software suppliers.

- Value proposition: the benefit of this support for TNO is that it can transfer its knowledge on the message interface specifications to its users, such that the message interface is implemented correctly. This leads to benefits for all organisations in the network as the specifications are properly used.
- Value creation: the benefits are created by developing implementation guidelines for the interface specifications, training opportunities, one on one support with the implementation, certification for correct implementation and so on.
- Revenue expectation: the revenue is hard to measure directly, but a correct implementation leads to more efficiency, less errors, better information and so on.

Opportunity 3: Transfer the knowledge on IT architecture and the specific roles for flexible energy demand and response to new SMEs in the energy arena.

- Value proposition: the benefit for these companies is that they get insight in new market opportunities
- Value creation: this benefit is created by organising workshops for SMEs in The Netherlands in which the added value of flexible energy market of the future is propagated.
- Revenue expectation: the revenue is hard to measure directly because it is up to the SMEs whether they take-up a role in this market.

3.3.4.5 Corresponding marker overview/SWOT analysis

Strengths	**Weaknesses**
The project seems to have a consortium with good knowledge in the combined domains of ICT and energy demand and supply. Thus, a solution for flexible energy data management will be considered as useful by energy companies	The world of flexible energy demand and supply seems to be something for the middle and long-term future. Thus, coming up now with a solution for flexible energy management can be experienced as being “too soon”.
Opportunities	**Threats**
Becoming experts for flexible energy demand and supply management and “spreading the word” on how to deal with this at all kinds of organizations in the	Other projects, initiatives and organizations are also busy in this field. Thus, a good alignment with them is very important for the success and uptake of

energy domain.	the MIRACLE results.

3.3.4.6 Exploitation activities

As mentioned in the opportunities in one of the previous sections, we have two types of exploitation activities: (1) knowledge transfer and consultancy and (2) support for implementation of the specifications. The entries in Table 1 can be assigned to the two types of exploitation activities as follows:

- knowledge transfer and consultancy: 1, 2, 6.
- support for implementation activities: 2, 6.

3.4 Exploitation of Academic Partners

The goal of MIRACLE's academic exploitation is not primarily on revenue streams (although it can include those as well) but knowledge transfer and in general the ongoing development of a target research area. Furthermore it is used to improve the quality of teaching. It follows a three step approach:

1. Create a state-of-the-art overview
2. Identify academic exploitation opportunities based on research within the Miracle project
3. Transfer knowledge and increase research visibility

The information gathered in the previous steps is used to conduct knowledge transfer projects. These projects can target different audiences like for example other research teams, industrial R&D (Research & Development) groups, ongoing or future projects or the general public. Potential exploitation activities of academic partners include but are not limited to the following:

- Publishing of papers/white papers
- Submitting articles to journals or magazines
- Speaking at conferences
- Offering seminars and workshops
- Doing an Open-Source publication
- Application for patents
- Working together with standardization committees; definition of or contribution to standards
- Doing trade-show presentations

3.4.1 AAU

3.4.1.1 Partner profile

Aalborg Universitet is a Danish public university with its core business being education, research, and innovation within the humanities and the social, technical, medical, and natural sciences. The university has approximately 14,000 students and more than 2,400 employees.

The Center for Data-Intensive Systems (Daisy) at the Department of Computer Science embodies extensive experience with the design, prototyping, and testing of data-intensive systems. Daisy maintains an evolving portfolio of externally funded international and national research projects that includes several EU projects. Research focuses on data intensive systems, in particular on technologies such as service-oriented architectures, data streams, temporal data management, spatio-temporal data management, mobile and distributed system architecture, data warehousing, data mining, and business intelligence.

3.4.1.2 General Exploitation strategy

AAU strives to become a thought leader in the research field of data management for the energy sector. Therefore, AAU targets the top-tier data management venues for its publications.

The business model of Daisy stands on three pillars: education, research, and collaboration. Daisy maintains an active program of industrial as well as traditional and interdisciplinary academic collaboration that spans student-based projects, networking activities, and funded research projects.

Collaboration with vendors of data-intensive products and services provide opportunities to integrate Daisy research results and ideas into existing products and services, and may lead to the development of new products and services based on new research results.

Since research is at the core of Daisy's mission, AAU collaborates with other computer science and IT researchers when there is a mutual interest and potential for synergy.

3.4.1.3 Identification of business / transfer opportunities

MIRACLE's research results will be the basis for future research opportunities and directions. AAU is promoting the research field of renewable energy and continuously seeks to become involved in research initiatives and projects in this area.

The mainly Danish EDISON project (Electric vehicles in a Distributed and Integrated market using Sustainable energy and Open Networks) develops possibilities for using a large fleet of electric cars to consume surplus energy (e.g., wind-based power generated at night) and deliver energy back to the grid from their batteries in case of demand peaks. EDISON only does this for new and additional demand but, unlike MIRACLE, not for the general demand that always exists. AAU takes into account the ideas and concepts learned in EDISON for the data management architecture. At the same time, we try to disseminate our ideas to the researchers working on EDISON.

Another Danish project in the field of energy management is EcoGrid. Its vision is to enable the Danish power grid to handle 50% wind power and other renewable energy. Now in its second phase, its focus is on technical solutions and on creating an economical balance among those solutions. AAU is pursuing to become involved and participate in similar energy-related projects now and in the future.

3.4.1.4 Description of business / transfer opportunities

The expertise gained in the architecture of data management systems in the energy sector can be applied in other areas where (1) a large distributed network of devices with sensors is involved and (2) there is a need to (potentially) negotiate with and disseminate information back to the devices. This is an interesting scenario that can be used for applications involving mobile devices/phones.

3.4.1.5 Exploitation activities and achievements

AAU is preparing a paper for a workshop at the top European data management conference (EDBT, Extending Database Technology). The paper outlines the techniques for aggregating the supply and demand of energy (in the form of so-called flex-offers) to allow a more efficient scheduling of these offers. Furthermore, AAU is preparing a research manuscript that is targeted for a top-tier data management journal, the VLDB Journal.

3.4.2 JSI

3.4.2.1 Partner profile

JSI is the leading Slovenian institution for pure and applied research in natural sciences and technology. It plays the role of a national institute, complementing the role of universities and bridging the gap between science and applications. In MIRACLE, JSI provides expertise in employing stochastic optimisation methods in real-world applications, focusing on scheduling .of aggregated flex-offers of energy supply and demand.

3.4.2.2 General Exploitation strategy

The general exploitation strategy of JSI as an academic partner relies on developing specific project-related knowledge, transferring it to various audiences, and using it to improve teaching.

3.4.2.3 Identification of business / transfer opportunities

We identify two specific opportunities: exploitation in teaching and exploitation in future research projects. They are both built upon the entry (7) from Table 1.

3.4.2.4 Description of business / transfer opportunities

Opportunity 1: Exploitation in teaching. JSI researchers involved in MIRACLE give undergraduate and postgraduate courses at the University of Ljubljana, Jozef Stefan International Postgraduate School and the University of Nova Gorica. Results of their research and development of scheduling energy supply and demand with focus on renewable energy sources will be incorporated into existing courses on stochastic optimization techniques. Students will have access to the developed tools and the opportunity to use them in accomplishing their curriculum requirements. Moreover, one researcher in the JSI team is preparing a doctoral dissertation based on the work in the project.

Opportunity 2: Exploitation in future research projects. JSI has already gained experience in production scheduling for energy efficiency and optimization of power flows in energy distribution networks through adaptable energy generation and consumption. The research on MIRACLE is expected to strengthen the basis for future activities in this field. This includes not only small-scale projects focused on the Slovenian energy grid and potentially funded by, e.g. Slovenian Research Agency, but also further international research projects.

3.4.2.5 Exploitation activities and achievements

JSI works on a related problem of optimal design of alternative energy supply systems based on renewable energy sources. Like in energy supply and demand scheduling, the task is to deal with conflicting optimization objectives: minimum costs and maximum energy efficiency. In use case analyses, JSI uses its own multiobjective optimization environment linked with a numerical simulator of alternative energy supply systems. Submission of a paper on this subject to one of major international conferences on stochastic optimization is planned for the first quarter of 2011.

3.4.3 TUD

Founded in 1928, the Technische Universität Dresden ranks among Germany's oldest technical-academic institutions of education, and its 14 faculties cover science and engineering, the humanities, social sciences and medicine. With more than 30,000 students and approximately 4,000 permanent faculty members, TUD is the largest

university in Saxony. Emphasis lies on interdisciplinary research and close cooperation with local industries and with the region's numerous science institutes and societies.
The Database Technology Group (DBTG) at the Faculty of Computer Science mainly focuses on database technologies for efficient large scale data management and data analytics in the context of data warehouse infrastructures. Current research projects rely on the three main pillars of theoretical foundations, system architecture, as well as database infrastructure and range from storage and index structures, over query processing and optimization, to service-oriented architectures and data mining applications. Beside academic research projects, the DBTG is also involved in several cooperative industry research projects.Partner profile

3.4.3.1 General Exploitation strategy

TUD mainly targets an academic general exploitation strategy. This includes the transfer of domain knowledge from the other MIRACLE partners to our group as well as the exploitation of created research results for future projects as well as paper and article publications at top-tier conferences and journals. Apart from this, we use the MIRACLE project as use case for student projects, theses and educational purposes.

3.4.3.2 Identification of business / transfer opportunities

Based on the transfer of energy domain knowledge and the extension of expertise with regard to efficient large scale data analytics, and especially, to forecasting of energy data, we see the following more concrete exploitation opportunities:

- Paper/article publication at conferences/journals; PhD theses
- Expertise development for future research projects with regard to forecasting energy demand and supply (e.g., cooperative research projects with local industry)
- Teaching and education purposes; student theses

3.4.3.3 Description of business / transfer opportunities

In the following, we describe these three concrete exploitation opportunities in more detail:

Opportunity 1: Large scale data analytics is one of the current trends in database research. Especially, advanced analytics such as forecasting, clustering, or approximate query processing that go beyond traditional aggregation queries and the integration of these advanced functionalities into data management systems pose high potential research challenges. Therefore, the MIRACLE project provides an appropriate application area and challenging requirements for several high quality PhD theses. Hence, we plan to publish and present both the work package results as well as the related PhD theses results in the form of papers and articles at top-tier conferences and journals. At the same times, these publications transfer the created knowledge to the research community and to the general public. From an academic perspective the quality and quantity of these publications is the most important exploitation objective.

Opportunity 2: Apart from the forecasting of energy demand and supply as well as the efficient large scale data analysis, we plan to exploit the created expertise in the energy domain for future research projects as well. These projects can rely on the developed concepts and further enhance the accuracy and efficiency of the developed techniques or apply them in partly different application areas. Such follow-up research projects further allows the knowledge transfer from the academic perspective to the local industry by creating cooperative research projects.

Opportunity 3: Additionally, the MIRACLE project but also the detailed results of forecasting, data aggregation and analysis can be further exploited for illustrative education purposes. For example, we can use MIRACLE as an example use case for lectures on forecasting and advanced analytics. In addition, MIRACLE might be also used as the use case for student projects and student theses.

3.4.3.4 Exploitation activities and achievements

According to the three mentioned exploitation opportunities, we now give an overview over current exploitation activities, results achieved so far, and planned activities for the next future.

Opportunity 1: Publications; PhD theses; Student theses

- Ongoing PhD theses:
  - Ulrike Fischer: "Physical Design Tuning for Forecast Queries", PhD Thesis, TU Dresden.
  - Lars Dannecker: "Efficient Distributed Forecasting for Evolving Time Series", PhD Thesis, TU Dresden (employed at SAP AG).
- Ongoing student theses:
  - Christopher Schildt: "Cost-Based Selection of Parameter Estimators", Bachelor Thesis, TU Dresden, Advisors: Ulrike Fischer (TUD), Matthias Boehm (TUD).
  - Robert Schulze: "Maintenance Strategies for Forecast Models over Evolving Time Series", Diploma Thesis, TU Dresden (employed at SAP AG), Advisors: Lars Dannecker (SAP), Matthias Boehm (TUD)
- Accepted papers/articles:
  - Ulrike Fischer, Matthias Boehm, Wolfgang Lehner: Offline Design Tuning for Hierarchies of Forecast Models; Appears In: Proceedings der GI-Fachtagung für Datenbanksysteme in Business, Technology und Web (BTW 2011, Feb 28 – Mar 4 2011, Kaiserslautern, Germany), 2011.
- Planned papers (next three months)
  - Lars Dannecker, Matthias Boehm, Wolfgang Lehner, Gregor Hackenbroich: Forecasting Evolving Time Series of Energy Demand and Supply; resubmission.
  - Lars Dannecker, Robert Schulze, Matthias Böhm, Wolfgang Lehner: Forecast Model Maintenance over Evolving Time Series Using Model Histories; initial submission.
  - Lars Dannecker, Matthias Böhm, Ulrike Fischer, Frank Rosenthal, Wolfgang Lehner, Gregor Hackenbroich: A Survey of Forecast Models for Energy Demand and Supply; initial journal submission.

Opportunity 2: Expertise development for future research projects

- Regular discussion workshops (April 15 2010; April 30 2010; May 26 2010; October 18 2010; January 18 2011) with DREWAG Dresden, a local DSO, and Robotron Datenbank-Software (RDS) GmbH Dresden, a local vendor of a commercial energy data management system.
- Pre-proposal "Time Series Forecasting for Renewable Energy Sources" (December 17 2010) of a cooperative research project together with Robotron Datenbank-Software (RDS) GmbH Dresden at the Sächsische Aufbaubank - Förderbank - (SAB), the central development agency of the Free State of Saxony, Germany.

Opportunity 3: Education and teaching

- We used MIRACLE as an example use case within the forecasting lectures of the course “Data Integration and Analysis” held in summer term 2010.
- It is also intended to use MIRACLE again as an example use case within the forecasting lectures of the course “Data Integration and Analysis” held in summer term 2011.
  In addition to educational purposes, we offer several thesis topics strongly or loosely related to MIRACLE.

3.4.4 CRES

3.4.4.1 Partner profile

The Centre for Renewable Energy Sources and Saving (CRES) is the Greek centre for Renewable Energy Sources, Rational Use of Energy and Energy Saving. CRES has been appointed as the national co-ordination centre in its areas of activity by Law 2244/94 and Law 2702/99. CRES was founded in September 1987 by the Presidential Decree 375. It is a public entity, supervised by the Ministry of Environment, Energy and Climate Change and has financial and administrative independence. Its main goal is the promotion of renewable energy sources, rational use of energy and energy saving applications at a national and international level, as well as the support of related activities taking into consideration the environmental impacts, on energy supply and use.

3.4.4.2 General Exploitation strategy

Miracle results are not only limited to a software product for utility companies. The process of creating the final system incorporates exploitable knowledge and technology transfer applications on different research fields such as European Electricity Market Operation, Demand Side Management with Flexibility and Forecasting Electricity Supply and Demand.
CRES exploitation strategy is firstly to shape a thorough and state overview on these research fields especially on the Electricity Market Operation and Demand Side Management including Flexibility, then to deepen to specific research topics such as the introduction of micro – requests into electricity market operation and demand side management tactics through flex-offers into smart grids and micro grids.
More specifically, introduction of micro – requests reflects to enhancement of the prosumers’ role and to bigger liberation of the electricity market in general which is highly requested on the Greek market in particular. Also, the concept of flex-offers incorporated into control algorithms of CRES developed smart grids and micro grids would be highly interesting to be studied for the results produced from this interaction.
The gained knowledge from the Miracle results exploitation on these research fields and the increased transfer know - how that will be added from the opening and continuance of Miracle concept to these research fields and to its implementation on bigger scale projects.

3.4.4.3 Identification of business / transfer opportunities

Business and transfer opportunities of Miracle exploitable results for CRES can be identified on CRES dual role and as the Greek National Energy Centre and as a Research and Technological Centre as well. Under these two roles the business/transfer opportunities identified are:

Opportunity 1: Transfer knowledge opportunity of the roles and processes description and the ETSO model to the Greek role model adaptation

CRES as the Greek National Energy Centre is an organization that contributes to the development of energy matters on Greece from legislation issues to applications and implementation, acting as the official government consultant. Doing so, CRES identifies the opportunity of transferring the knowledge from Miracle's results on electricity markets' roles and processes description and relation with the ETSO role model in order to contribute to the formation and reconstruction of the Greek role model.

Opportunity 2: Business opportunity of applying Miracle's technology on smart girds and micro grids facilities
CRES as a Research and Technological for renewable energy sources, rational use of energy and energy saving can identify a business opportunity on Miracle's new technology by applying it to more testing smart grids and microgrid facilities of bigger scale for further researching its results and consequently for technically supporting electricity market players for the penetration and the implementation of Miracle concept on it.

Opportunity 3: Knowledge transfer and dissemination of results through scientific journals, conferences and seminars
CRES can amplify its research activity and presence to energy sector journals and conferences by submitting papers/ articles and doing presentations and speeches disseminating and transferring the knowledge and results derived by the Miracle's implementation and in particular its testing to the smart grids, micro- grids facilities.

Opportunity 4: Know – how transfer through capacity building projects and new projects design and implementation with strategic partners
CRES though the implementations of numerous capacity building projects on energy sector organizations of developing countries can widely disseminate and transfer the know – how of Miracle's demand side management through flex-offers.

3.4.4.4 Description of business / transfer opportunities

CRES on its role as the official Greek government consultant on matters of renewable energy sources, rational use of energy, energy saving national policy, strategy and planning has identified great potential of the knowledge transfer from Miracle's exploitable results. More specifically, the results from the roles and processes description of the ETSO role model and its relevance to each country's role model could be beneficial for the ongoing liberation of Greek electricity market and to its transference from a public vertical model to a competitive market model.
CRES can contribute to the discussion of the relevant bodies including Ministry of Environment, Energy and Climate Change, Hellenic Transmission System Operator (HTSO), Regulatory Authority for Energy (RAE) and Public Power Company (PPC) for the reforming of Greek electricity market and to the adaptation of a role model close to the ETSO role model. Also it can contribute to the specification of the respective standard issued for the Greek electricity market role model by the Greek standardization body ELOT or to the publishing of technical directives issued by Technical Chamber of Greece regarding roles and processing on Greek electricity wholesale market.
Moreover, CRES on its activity to supervise and carry out demonstration and pilot projects of new technologies could exploit and disseminate successfully Miracle's concept of flex-offers on demand side management by incorporating them into already existing or new developed pilot smart grids and micro grids of bigger scale. By properly presenting and making known the advantages of introducing flex-offers to the electricity markets and their portray of these advantages through smart grid interaction to

stakeholders such as P.P.C or General Secretariat for Research and Development or even local authorities and professional associations, CRES could target for funding of such pilot projects for further testing and confirming Miracle's results.
Also CRES through organizing and/or participating in technical and scientific seminars, educational programs and specialized training courses or meetings of technical/scientific organizations or universities could disseminate Miracle technology and its impact on the electricity sector. CRES can contribute with the submission of papers on specific targeted conferences and scientific journals as well as with extended presentations on workshops and seminars. In particular, CRES could disseminate the results of the trial testing of Miracle prototype into different scenarios on its microgrid facility on conferences and workshops organized on Greece by organizations such as Technical Chamber of Greece (TEE) or National Technical University of Athens (NTUA) or itself, but also to abroad on international conferences.
Finally, CRES has a close cooperation with energy institutions of developing countries like Jordan (NERC), Lebanon (ALMEE), Ukraine (NAER), Azerbaijan (State Agency for Alternative and Renewable Energy Sources) where it performs capacity building projects on energy sector. Under those projects' scheme CRES could transfer the knowledge gained from Miracle project on electricity trading operation and demand side management tactics to those countries either by just introducing this knowledge on seminars and training sessions or identifying a potential pilot smart grid project for transferring this knowledge more efficiently.

3.4.4.5 Exploitation activities and achievements

Under the two types of exploitation activities: knowledge transfer and technology transfer projects identified in Table 1, CRES identified opportunities and exploitation activities can be assigned as follows:
Knowledge transfer: Opportunity 1, Opportunity 3
Technology transfer projects: Opportunity 2, Opportunity 4

The visible achievements from the above mentioned opportunities and activities for CRES can be shown after the first trial testing of Miracle's system to its microgrid facility on the selected scenarios identified and described. This first trial site testing will give us the opportunity having concrete results and data for the system's behavior and performance. Based on those results, it can be proceeded the activity of further using the system in bigger scale smart grids interacting with their control algorithms for demand side management and supply control. Also, these results can be the material base for papers, articles submission and seminar, workshops lectures.
However, the exploitable knowledge from the electricity market roles and processes and the ETSO role model can be used in the first identified opportunity for contribution to a discussion on reforming the Greek role model or to the production of a standard for that scope.