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BUSINESS PROCESS FRAMEWORK AND IT ARCHITECTURE FOR SMART METER READING

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Abstract
The implementation of smart metering has an impact on the energy business processes and the corresponding enterprise IT architecture. The utilization level of the new meter assets and system support sets the amount of new services and internal efficiency that can be provide by the investment. Optimizations in terms of streamlined business processes, reduced costs, increased profit, lower end-user prices and by considering environmental aspects, less energy losses and optimal energy production can be reached by the entire energy process starting with generation, grid and transmission processes, distribution and energy consumption. Business drivers for the implementation are beside law, government, regulator and sometimes the energy companies themselves in particular business informatics and the IT services.

1. Smart Meter Reading, State-of –the-Art

1.1. Objectives

The deregulation process is engaged in different phases throughout Europe. Some of the countries (like UK and the Nordic countries) are the trendsetters, in other countries deregulation is in the fledging stages (like some countries in East Europe and France). In the meanwhile energy and energy supply is perceived not only as a topic of market economy, but also as a climate and social problem. This seems to be a contradiction, but with new approaches this knot can be loosed as a win for business as well as for society and the environment. Beside the logical objectives in getting more accuracy and transparency in meter data collection, like

- Predicting and balancing the generation
- Predicting and balancing the grid usage
- Increasing the customer satisfaction due to consumption-based meter to cash processes

there are potential advantages in the conceptual design of new processes, like

- New pricing models allowing short term tariffs

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- Controlling the electricity usage through prices, promotions, campaigns etc. under consideration of e.g. weather forecasts for wind, sunshine hours, tides etc.
- Emerging and boosting sales opportunities with new rating models (daily or hourly changing tariffs with the possibility of customer choice) and bundled products (e.g. digital meters and smartphones including energy usage optimization software)
- Realizing smart grids through balancing of energy generation and energy consumption under consideration of short-term and mid-term climate factors, new household technologies (battery technology, household fuel cells [1]) and new automotive technologies (electric cars as consumer and supplier)
- Integrating smart home technology with smart meter reading using IT technologies like SOA, Web 2.0 and mobile
- New business models like e.g. special tariffs for electricity cars, combined consumer / supplier models, home based total energy units.

But who will be the driver for such a technology change? The European Union and the several local governments with their respective regulatory authorities have already announced the necessary usage of Automatic Meter Reading (AMR, see definition in chapter 2) [2]. The therefore required regulations and laws are still missing and it may take some time differing country from country to provide the corresponding legal framework. The business parties are carrying out first pilots to gather the knowledge of technology, but not aiming to deliver a comprehensive solution in a short or mid-term range (with exception of Sweden and Finland, where AMR is forced by government). Some prognoses are hawking that e.g. Germany will get such a digital setup not before 2020 [3] [4] [5]. Even it is unclear who of the companies at the different deregulation levels should go for the surely required starting investment.

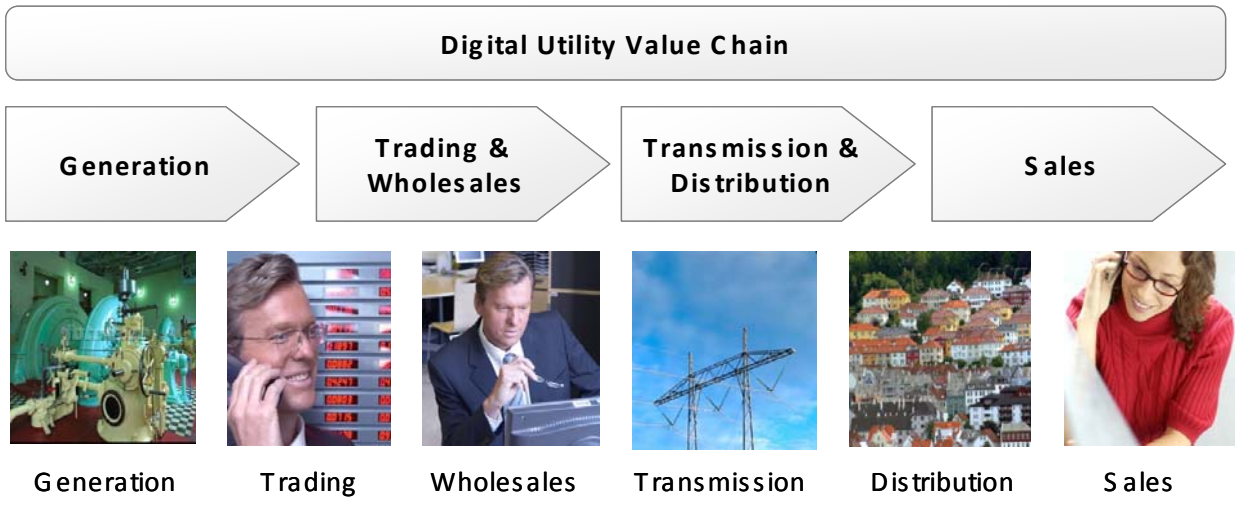

Fig. 1: Typical market participants of the deregulated utilities industry

At least there are the generation company, the transmission or grid company and the distribution and sales company (sales and distribution normally is integrated in one company) who will have advantages by using of AMR. Due to missing or not seen business opportunities none of them is really investing in this technology. Furthermore some regulation guidelines (like in Germany) allow another market participant, the metering point operator. This meter point operator could own and administrate (or only administrate) the meters and therefore generate a new business. But no one is venturing into that opportunity because of risks and imponderabilities in all circumfluent parties, laws and regulations.

This Digitalization of the information flows in the energy industry must be supported by computer technology and informatics. So the real driver for this major change could be IT service companies and IT affine consulting companies. Providing cutting-edge business models and the required IT architecture will push the market participants to buy in these new models and IT infrastructure. The fist adaptors will be the real winners of this next-generation regulation [6]. But although the number of consumers and customers is determined, the market volume in terms of potential revenue and profit will grow dramatically in the next decade.

For the verification and validation of the potentials of Smart Meter Reading (SMR, see definition in chapter 2) a business process framework and scenarios for the suitable IT infrastructure are required. This article shows some examples of such an environment. Informatics and especially Business Informatics are the suitable disciplines for developing the framework for the future energy market. New business models like partnerships between IT service providers and energy companies could build the suitable objects for driving reality.

1.2. State-of-the-Art

Energy companies in Sweden and Finland are urged by law to implement AMR latest till mid of 2009. In Germany some of the major energy companies started (or announced) pilot projects to learn about the new technology. But they have not really started digital meter data management and hence are at the real start on the roadmap to SMR.

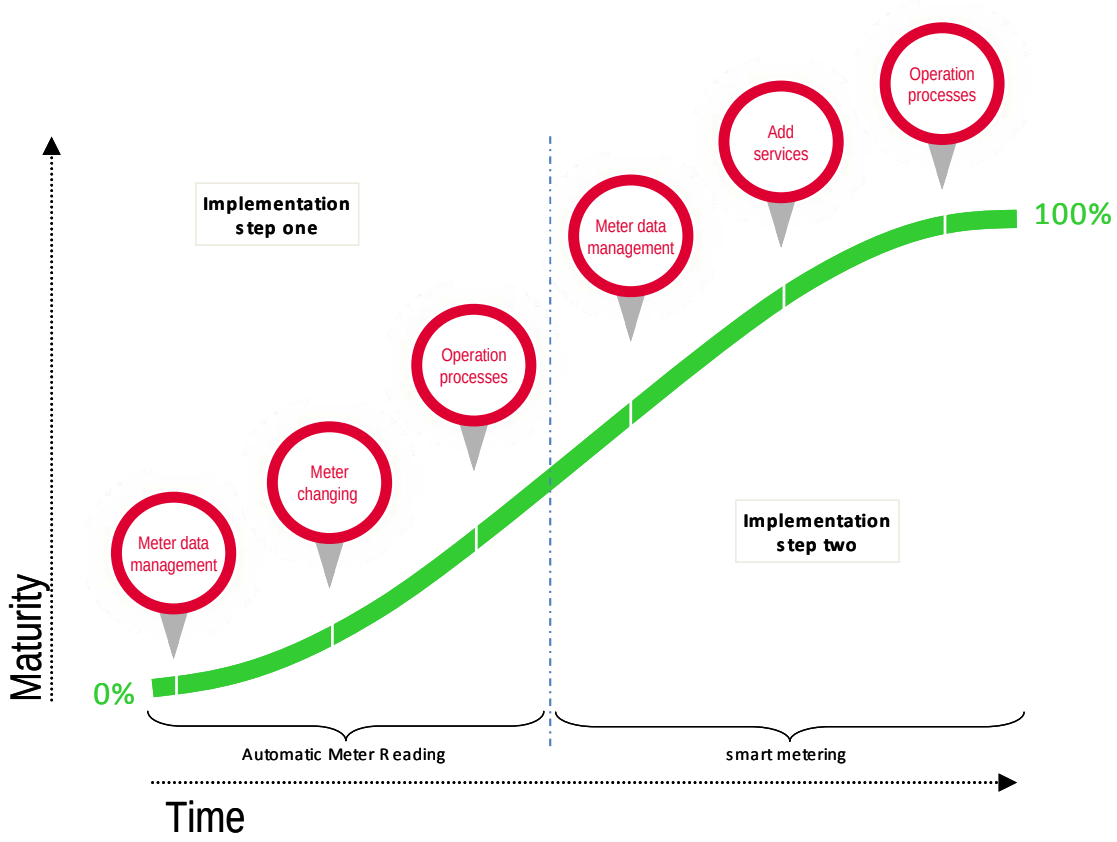

Fig.2: Roadmap for the implementation of SMR

- EnBW has now 1000 pilot customers using AMR. They have to plan to enable every EnBW (distribution) customer to use an automatic meter starting by mid of 2008. The target group for 2008 are customers owning a house or at least an apartment. The current electricity

consumption will be displayed directly in the meter and in a computer-based cockpit with some additional information (current kWh, Costs or CO_2). Beside getting information about the energy consumption the customer doesn't have any real or monetary benefit. The meter data is collected hourly. So probably only technique affine consumers will be the early adaptors. The advantage for EnBW is the increasing knowledge in how to use the new technology and how to optimize business processes with this additional data [7].

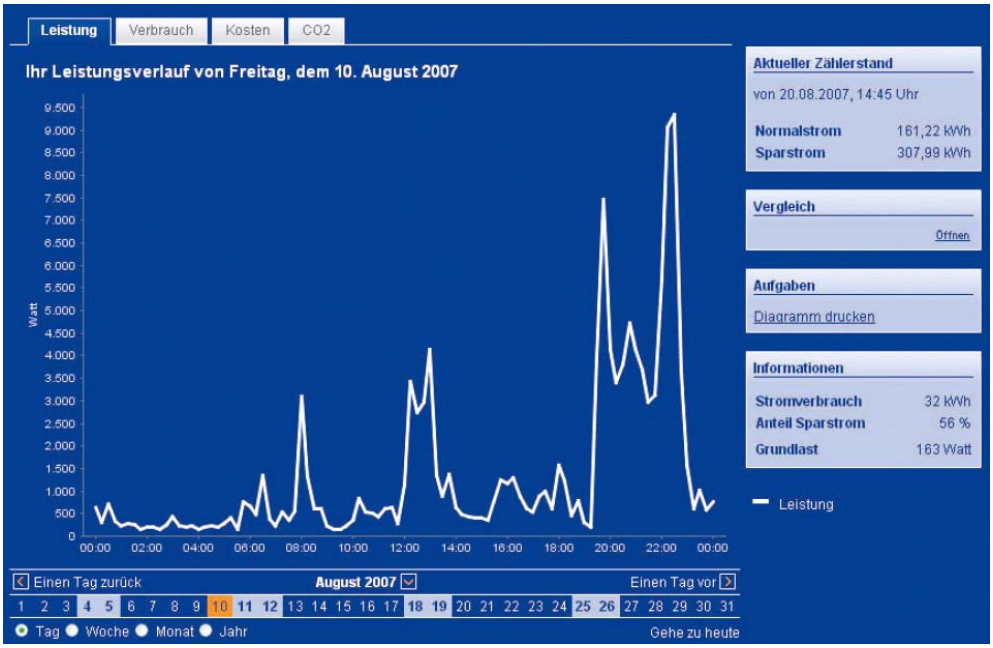

Fig.3: EnBW energy cockpit: consumption gradient

- RWE has planned to provide 100000 customers in Mühlheim with automatic meters in the next 3 years (target for 2008 is 10000 automatic meters). The current electricity consumption should then be shown on displays, TV, PC or mobile phone. In addition the extension to gas and water consumption figures shall be possible. The project should start in the mid of 2008, but is already postponed. RWE budgeted this project with 20 million Euros. [8]
- E.ON has realized 500 automatic meter installations in 2007 and is planning to implement 10000 smart meters till 2009 at customer sites [9].
- Vattenfall Europe has implemented a pilot project with respectively 500 smart meters in Hamburg and Berlin [10].

So in Germany the wave has still to raise. Compared to the rest of the World this e.g. Enel in Italy with 30 million automatic meters, the Nordics with around 6 million digital meters in Sweden and Finland or even Trinidad and Tobago with 400 thousend automatic meters till end of 2009, Germany is still in the initial starting phase [11].

2. Definitions

Unfortunately new developments are always starting with a lot of terms, abbreviations and acronyms consisting of many redundancies, inferences, synonyms, homonyms and polysemy. In order to differentiate the following terms the definitions are ascertained.

- Automatic Meter Reading or Digital Metering (AMR)
- Automatic Meter Management (AMM)

- Automatic Meter Infrastructure (AMI)
- Smart Meter Reading (SMR)

Automatic Meter Reading (AMR):
With the term Automatic Meter Reading (AMR) the sole digital collection of meter figures is described.

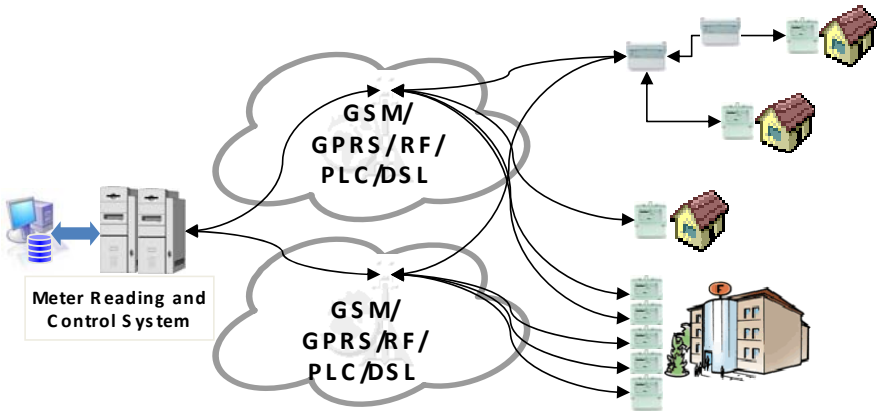

Fig.4: Automatic Meter Reading (AMR)

Questions for Business Informatics are the technology used for the collection of the meter data and the interface programming required for the connection of digital meter to the collection technology and from the collection technology to the meter reading control systems. Already used technologies are:

- GSM: Global System for mobile Communication
- GPRS: General Packet Radio Service
- RF: Radio Frequency
- PLC: PowerLine Communication
- DSL: Digital Subscriber Line / Internet connection

Automatic Meter Management:
In addition to AMR AMM contains the integration of the internal backbone like e.g. with the ERP and the CRM application.

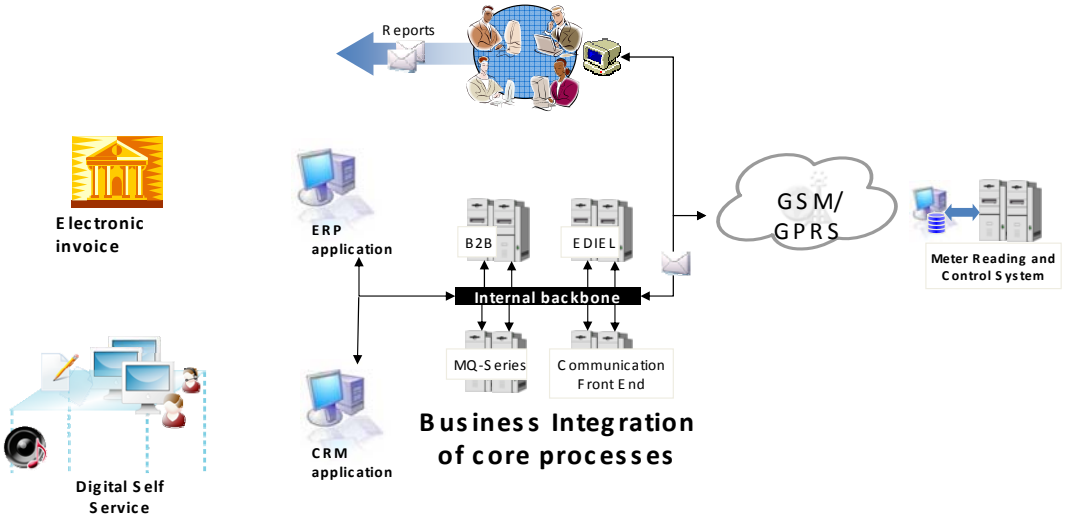

Fig. 5: Automatic Meter Management (AMM)

The advantage for the energy company is the digitalization of involved business processes.

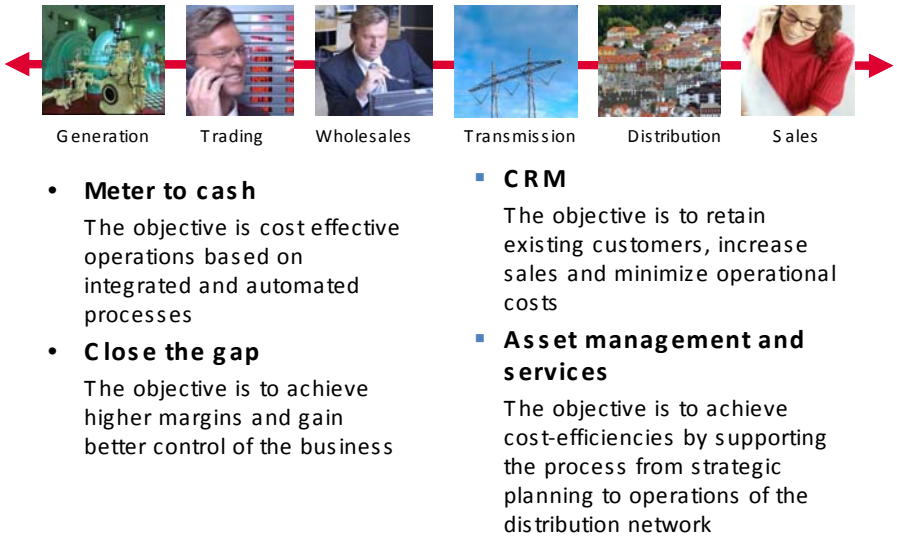

Fig. 6: Business processes supported by AMM

Therewith the energy companies are able to achieve higher margins by reducing the data collection costs and to gain better control of the business by optimizing the meter-to-cash process and being able e.g. to design a better dunning and meter locking process.

Automatic Meter Infrastructure (AMI)

Supplementary to the functionality of AMM AMI extends the processes to the customer. There are push information processes to provide customers or consumers with information about his consumption, new prices, promotions or occurred inconsistencies. Beside that the customer has a wide range of customer self service functionalities to get information about invoices, consumption and reports and to interact in with an energy online shop or only to change his own data (pull information processes).

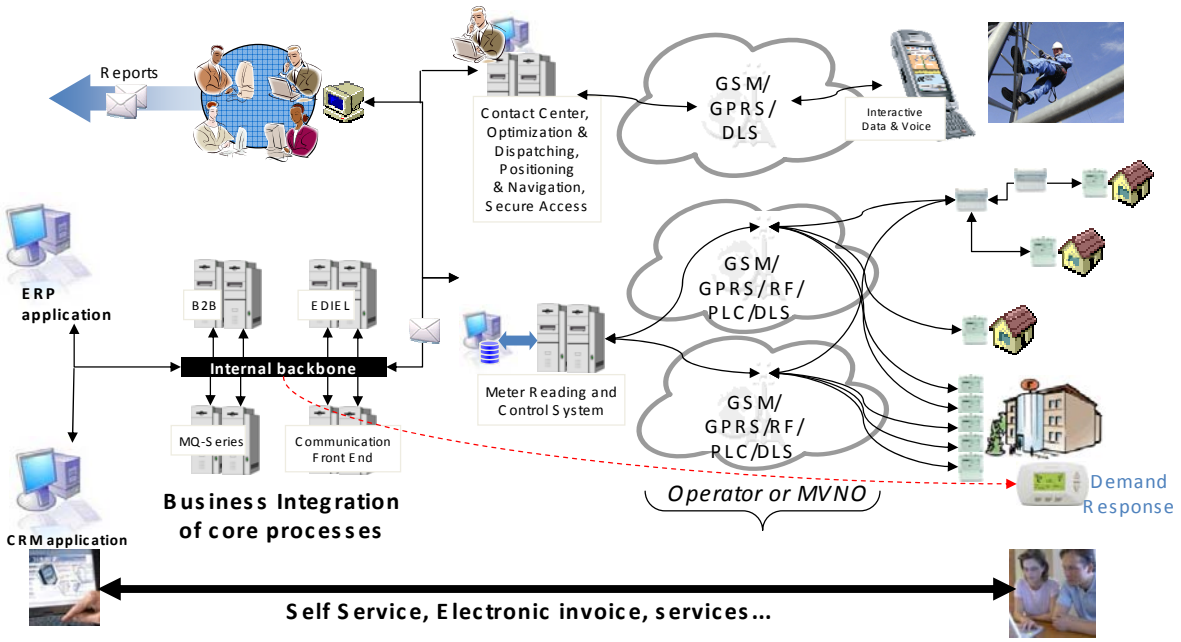

Fig. 7: Automatic Meter Infrastructure (AMI)

Even the digital meter allows interaction between the customer and the supplier (push and pull information processes). For that it must be defined who overtakes the role of the information service provider (IT service company, meter point operator, mobile virtual network operator (MVNO), distribution company or grid company). Also it must be clear which services are for free and which are allocated with costs.

Smart Meter Reading (SMR)
Smart Meter Reading (SMR) is based on the Automatic Meter Infrastructure (AMI) regarding the technical or hardware aspects. Over and above SMR extends the functionality with additional information and interaction processes (Software of human services) and includes services beside the energy supply like intelligent house technology, mobile, computer networks (DSL, WLAN), audio and TV. This offers the energy companies the possibility to widen the range of their services, to offer new bundled products and in particular to have a more aggressive rate policy in order to attract new markets and customers.

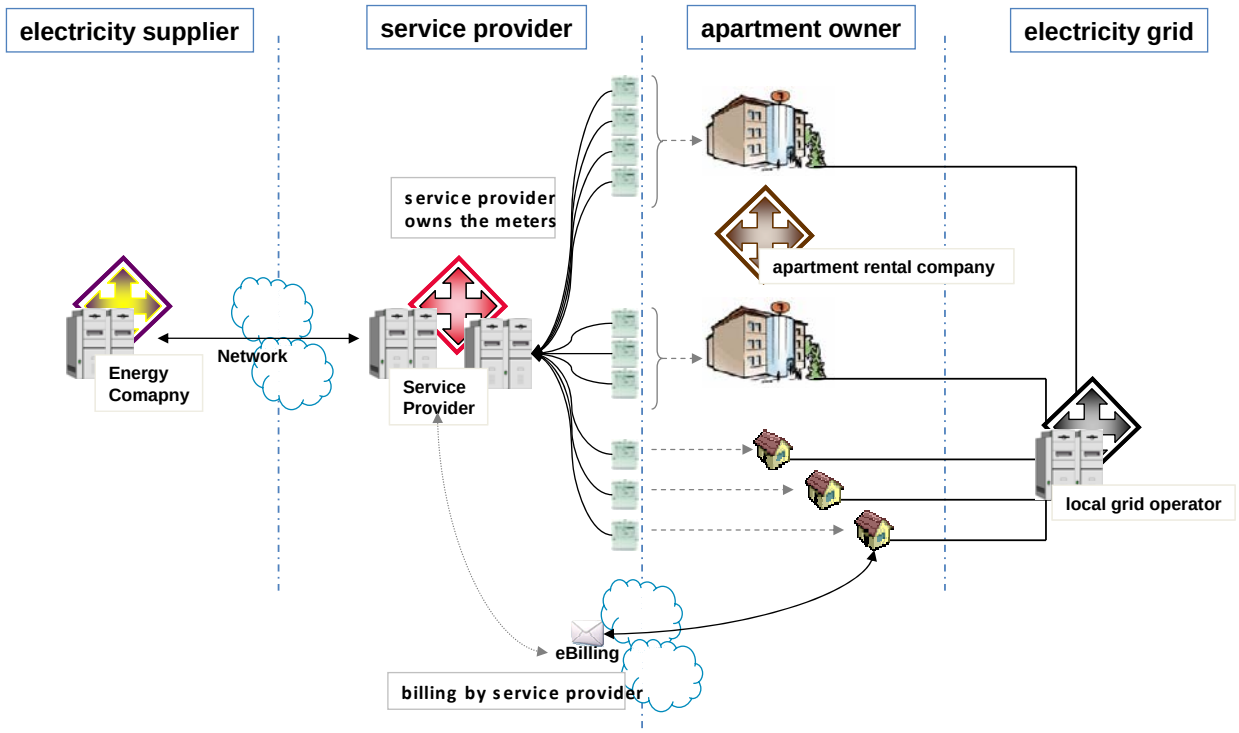

Fig. 8: Smart Meter Reading (SMR)

Smart meter reading requires an organizational unit which is providing all services. In an overall completion the service provider owns and administrates the meters (act as meter point operator) and overtakes the meter-to-cash process as service for the energy company.

The first step for the implementation of SMR is a Business Process Framework which indicates the added value for the energy market participants.

3. Business Process Framework for Smart Meter Reading

First of all it is obvious to decide about the IT architecture framework and modeling methods which should be used for development of the Business Process Framework. E.g. the German Association

of new Energy Suppliers (Bundesverband neuer Energieanbieter, BNE) is using the Unified Modeling Language (UML) [12]. The Business Process Framework for Smart Meter Reading (BPF for SMR) is and has to be developed by using existing IT architectures and modeling methods like UML (sequence diagram, activity diagram, use case diagram and class diagram) and well-known process oriented modeling methods like ERM, flow charts, value added chain diagrams and process survey diagrams. Decisive is the tangibility for users of the energy companies.

In the following a short abstract of the BPF for SMR is instanced. Beside the business processes the methodology and approach for the implementation project has to be defined (Big Bang or partial implementation, required time period, new customers first or specific areas or type of energy first etc.).

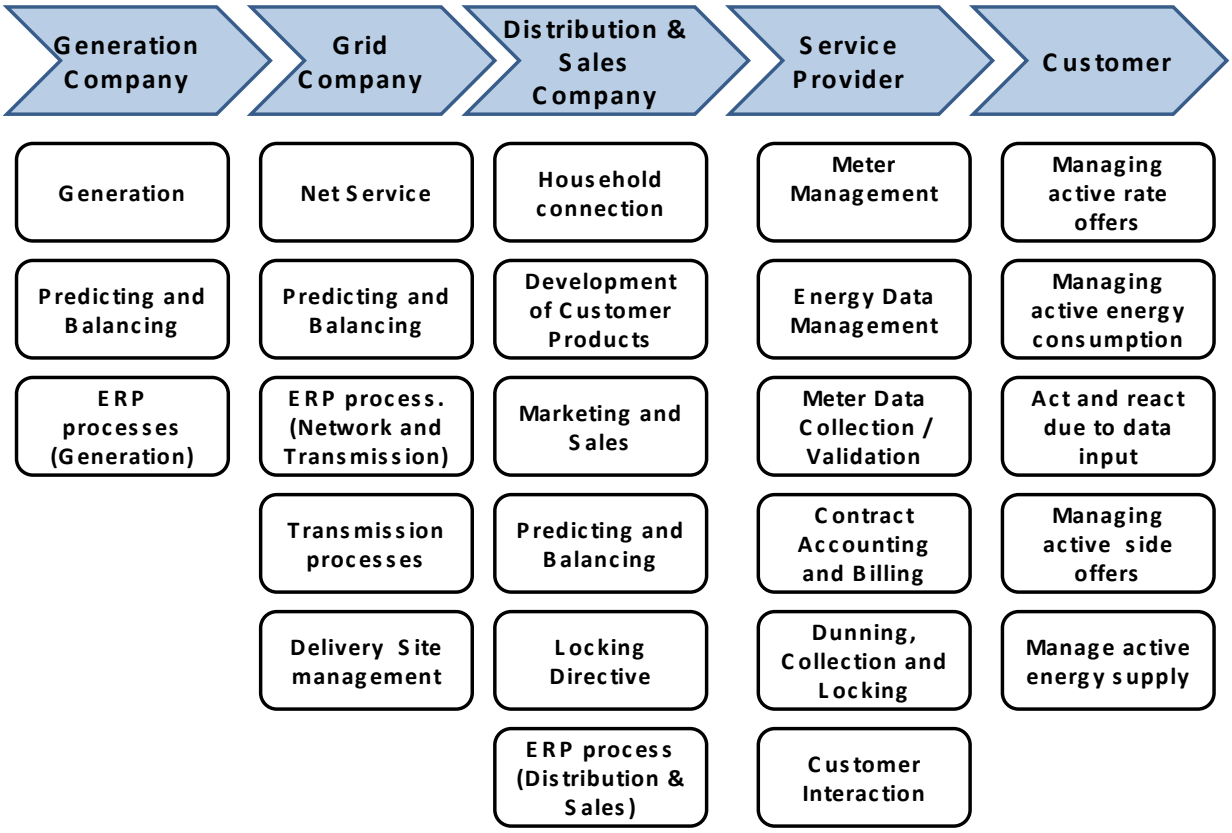

Fig. 9: Process Survey for SMR oriented processes

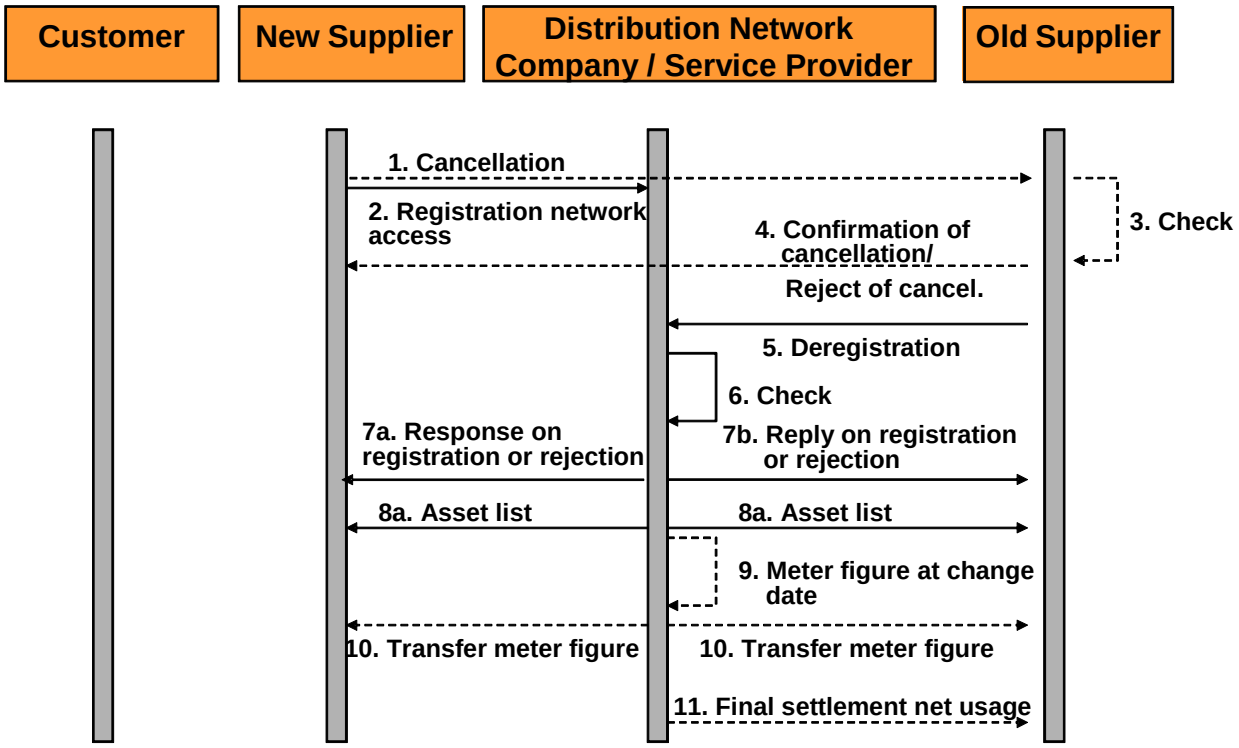

Fig. 10: Sequence diagram of supplier switch process [13]

4. IT Infrastructure for Smart Meter Reading

The eventually used IT infrastructure depends on the current applied IT of the energy companies. Implementing SMR does not yearn for new ERP packages (Enterprise Resource Planning) or only Service Oriented Architectures (SOA). But it is afflicted with benefits using a SOA with all possibilities to integrate and interface services, tools and hardware. A broad overview of a possible IT infrastructure gives the following figure.

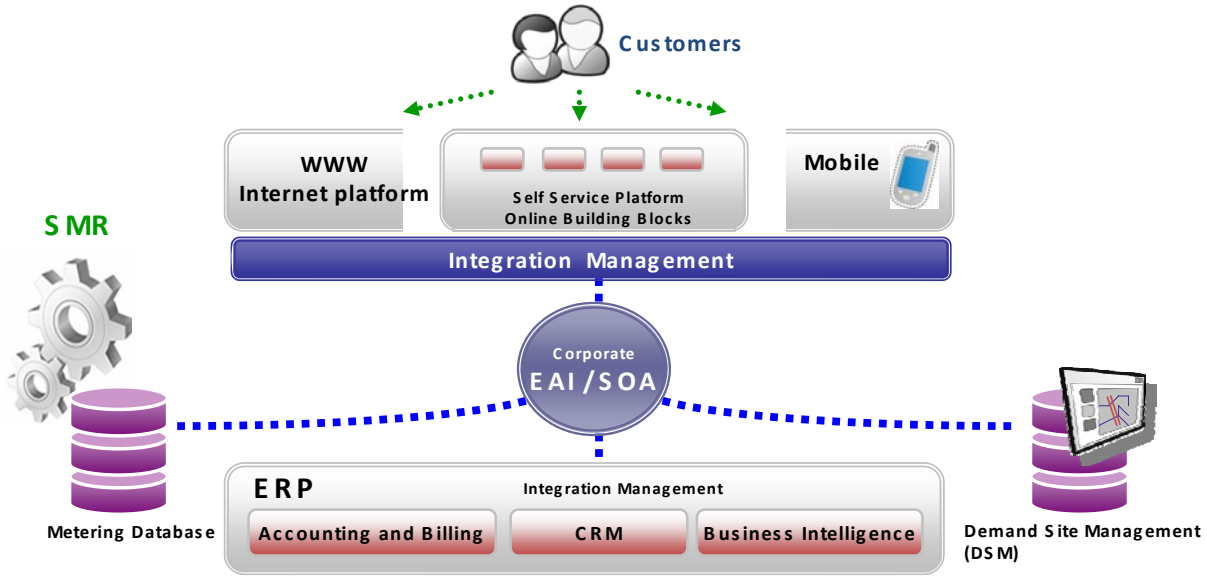

Fig. 11: IT infrastructure for SMR [14]

5. Next steps and Prognoses

Discussions on alternative business models are ongoing. Several parties are involved, independent or in strategic partnerships. Key roles for the development of SMR are in the hands of the EU, the governments, the regulation authorities and the energy companies. Beside that the main drivers for a next generation regulation will be universities and scientists, IT service companies, consulting companies and for sure the public influenced by press and media.

The question is not “Is SMR coming or not?” but “When does the respective country starts to implement SMR?” and “How will SMR change the current energy business?”.

Prognoses with a high certainty are difficult. In comparing the energy business with the telecommunication and mobile branch it is more or less sure that the digitalization of energy related information will boost dramatically. Therefore the integration of all digital information for the consumer will be one of the crucial questions for a severe extension of the energy related business. Nobody can avoid coping with these questions and this new business. By providing Business Process Frameworks and possible IT infrastructures through science, IT service companies, consulting companies and software development companies, the energy companies will get the momentum to start with Smart Meter Reading and to reinvent customer oriented business not only with energy but with services and information.

6. List of literature

[1] compare http://www.ise.fhg.de/geschaeftsfelder-und-marktbereiche/netzunabhaengige-stromversorgungen

[2] Energiewirtschaftsgesetz (EnWG), Origin version at 24. April 1998 (BGBl. I S. 730), 2. amendment (Art. 7 Abs. 14 G at 26. March 2007 / BGBl. I S. 358, 367), release of 2. amendment 1. June 2007 (Art. 8 G at 26. March 2007)

[3] see www.atkearney.de/content/misc/wrapper.php/id/50443/name/pdf_atkearney_eb_smart_metering_1224844706 1440.pdf

[4] see: http://w1.siemens.com/innovation/de/publikationen/zeitschriften_pictures_of_the_future/pof_fruehjahr_2008/e nergie/uebertragung.htm

[5] see: http://www.scatterweb.de/downloads/ENER-DAT_Informationen_November_2008.pdf

[6] THE McKINSEY QUARTERLY., Next-generation regulation for European electric power, June 2008.

[7] see http://www.enbw.com/pioniere

[8] see http://www.rwe.com/generator.aspx/rwe-energy/language=de/id=152038/rwe-energy.html

[9] see http://www.eon-bayern-vertrieb.com/pages/eby-vertrieb_de/Privatkunden/Serviceleistungen/EnergieSpar-Helfer/index.htm

[10] see http://www.berliner-impulse.de/fileadmin/Berliner_Energietage/2008/E6_Berding_BET2008.pdf

[11] see http://maps.google.com/maps/ms?ie=UTF8&hl=en&msa=0&msid=115519311058367534348.0000011362ac6 d7d21187&ll=53.956086,14.677734&spn=23.864566,77.519531&z=4&om=1

[12] see http://www.neue-energieanbieter.de/energiethemen/messwesen/1187746.html

[13] compare http://www.vdew.de/bdew.nsf/id/C72383C3FEE2414EC12573E00031F54B/$file/2007-11-23-DuM-Kapitel-7-MSB.pdf, page 15

[14] Wireless M2M communication and AMR, Berg Insight