Road Map for Smart Grid Implementation in Israel

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The Israeli Smart Energy Association

Executive Summary

1. Introduction

The Smart Grid is one of the main drivers of the future development of the world energy networks.

Most of the developed countries have set up quantitative targets and milestones for deployment until 2020 and 2030 and have allocated significant budgets for the implementation.

Israel is an "interesting case". On the one hand the Israel Electric Company (IEC) has installed advanced control and supervision systems in the transmission and distribution segments. On the other hand Israel is lagging behind in all elements related to the end user premises. The first trial is being performed these days and is scheduled to be completed during the first quarter of 2014.

The Israeli Smart Energy Association (ISEA) took upon itself to prepare a comprehensive document analyzing all aspects of the Enhanced Smart Meter deployment: Technology, Engineering, Regulation, Legal, Marketing, Economic (CBA) ,and role of the local industry.

This document analyzes the Smart Grid in an objective manner from the point of view of the national economy.

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What is Smart Grid?

Smart grid is a modernized electrical grid that uses information and communications technology to gather and act on information, such as information about the behaviors of suppliers and consumers, in an automated fashion to improve the efficiency, reliability, economics, and sustainability of the production and distribution of electricity.

Smart Grid represents a new approach to meeting the needs of the new (power) world, where consumers will be able to interact with the power system for both consumption and generation through automated and intelligent control of their electrical appliances, thereby acting as resources for the power system.

Smart Grid objectives

The general objective is: To transform the electric grid to achieve sustainable energy future for the public good.
Smart grid goals may be classified by numerous different categories: On aggregate level (Global, National, Operators, and customers) and on functional level (Technical, operational and marketing). The Operational and Technical goals are mainly related to factors such as reliability, survivability, efficiency, security, resilience, improving asset utilization and operational efficiency, and have a direct impact on peak demand reduction, decrease of minutes of interruptions, integration of renewable, and reduction of greenhouse gas emissions.

The marketing goals have to do mainly with implementation of intelligent real time pricing, reduction of monthly bill payments by controlling electricity consumption and turning the typical energy customer from being passive to being active.

Each player has its own different preferences. The point of view of the operator is not necessarily matching to that of the customers, manufactures, service providers and so on**. This paper is trying to represent the national interest.**

The international experience

The world experience gained to date shows the trends and the variation of different ways of deploying the smart grid concept as a result of the specific needs and background of the grid before adopting the smart grid technologies.

It is clear that the smart grid is a fact. The question is not IF but WHEN and HOW.

The insight for the Israeli market:

First do a trial - Most countries perform technical and marketing trial before deploying the system worldwide.

Determine an adequate incentive to implement the smart grid technology- Common to all countries is the gap between the time the smart grid will show the real benefit and the period of investment. This phenomenon is called “CAPEX time-shift problem”. The key factor for success is introducing the right pricing that will motivate the end user to cooperate and save electricity.

2. Technology

Technology is an answer for a need, not an objective by itself.

Smart grid consists of many different technologies, appropriate to multiple disciplines, addressing two main segments:

1. The grid itself - This will include the following elements: Sensors, Connectivity, Communication, Security, Privacy, Real time, Data Sharing, Interfaces, Visualization and Operation
2. End consumers and small scale generation facilities.

The integration of all these components presents numerous Challenges:

Implementation, Integration, Cost, Standardization, Open platform, Acceptance (operators and customers).

The key success factor is looking at the following three aspects, and ensuring all are dealt with carefully: segmentation, benefits, and technology. Resulting in one integrated system that can serve all the network players.

3. The End user as a stakeholder - marketing aspects

In a smart grid environment, customers play a critical role in energy reduction, as they become more proactive in energy management. This calls for engagement between the utility and customers.

Smart grid offers a paradigm shift for a new model of customer communications. A model that moves from providing information only to providing education, and then to engagement.

Customers have a significant role to play in the new service delivery ecosystem. If customers do not engage with new tools and reduce energy use, the business case for smart grid is dissolved.

Israel has to implement the best practices that have helped utilities around the globe gather success:

Understand Stakeholder Engagement Internally - Customer advocacy groups, Strategic collaboration initiatives

Educate in Phases- Breaking down the elements of information and planning communications in phases as the deployment phases evolve

Understand the Customer - Market research plays a critical role in communications program design

Test the Messaging - Testing on different customer segments will result in more targeted and effective communications plan. People are different. Segments are different. Regions are different.

Monitor - Track response, Prepare to alter the plan and have contingencies

4. The legal aspect

Israeli law does not currently provide a specific set of rules or regulations dealing with the Smart Grid. Like in the case of many technological innovations, the legal system does not necessarily provide the tools to address this development.

It is recommended to examine general provisions of law related to the following:

Privacy – Since there is a high probability that the exposure of data collected by the smart meters will severely harm users' right to privacy, it is advisable to think of specific legislation which will clarify that a person has a right to request the operator to disclose the information gathered about him (whether in crude or in analyzed form) to third parties who should bear the costs associated therewith.

Ownership of the information - The main questions are:

- To whom does the gathered information belong – to the operator or to the customer?

- Does the customer have the right to request the operator to transfer the information relating to it (whether in an analyzed form or in its original form) to a third party without any compensation?

The answers to such questions are not entirely clear and involve various areas of law, and it is therefore advisable that the legislator specifically address this matter.

Antitrust - In order to ensure the maximization of the efficiency of the Smart Grid, it is highly important to apply the essential facility doctrine and to consider the Smart Grid's operator as a monopoly, so:

- The operator will be prohibited from discriminating between various electricity producers and supplier; and
- The market will be open to offer consumers various tools to efficiently use electricity and reduce their bills.

Consumer protection - The customers of the Smart Grid are also end-consumers, which means that the Consumer Protection Law will apply to the relationship between the consumers and the service provider. The type of regulation which has to be implemented should ensure that the consumer:

- Will receive and understand in advance the various options and related rates.
- Will receive clear information about all the alternatives
- Will have the ability to easily understand their bills.

5. **Milestones for smart grid implementation**

In developing any large-scale, infrastructure-intensive field, it is necessary to set clear, measurable milestones. .

The challenges involved in implementing smart grid in Israel are partially unique to Israel but most of them are internationally common. These are the most important:

1. **Regulators consent** - Setting agreed upon policy among regulators regarding goals and means. Coordination among all direct regulators of the electricity market is a must.
2. **Defining the implementing party** - Defining the role of IEC and the private sector ensuring legal access to SG data.
3. Defining priorities - Setting priorities with the purpose of integrating different interests of the stakeholders, as well as presenting a clear picture of the final SG network. Smart grid should be an integral part in the National Energy Master Plan
4. **Data policy** - Determining rules to ensure open access as well as data confidentiality and security.
5. **Customer awareness** - Taking all necessary steps to build consumer trust. With the purpose of transforming the customers from being passive to assuming an active role in managing supply-side resources
6. **Technical solution**- Synchronizing and coordinating all the technical components being installed.
7. **Tariff** - Setting up an updated and flexible tariff policy.

Other recommendations:

1. **Expertise** - Identifying and enhancing areas of expertise currently found in Israel and leveraging that expertise.
2. **Funding** - Establishment of dedicated funds through electricity rates and/or Government budgets directed toward incentivizing promising smart grid development initiatives, including incubators to initiate new projects and technologies.
3. **Proven models** - Use of proven models from other countries in implementing cost-benefit analyses, until a significant wide trial will be executed.

6. Cost Benefit Analysis for Israel – Enhanced smart metering deployment

Mission statement

The aim of this report is to facilitate an informed investment decision for enhanced smart metering in Israel. The report serves this purpose by providing a coherent assessment of the quantifiable costs and benefits related to a nation-wide enhanced smart metering deployment in Israel. The use of the term enhanced points to the content of the entire system, specifically (1) smart meters, (2) communication components enabling real time, two ways communication the consumer and the infrastructure, (3) support software systems including billing system, (4) use of feedback enabling technology and (5) new and advanced tariff systems that embeds the potential of consumption pattern changes. With nation-wide deployment we understand (1) the household sector and (2) the small-to-medium enterprises (SME), a total of 2.54 million meter-points at the assumed start of the CBA (01.01.2015).

Macro assumptions and methodology

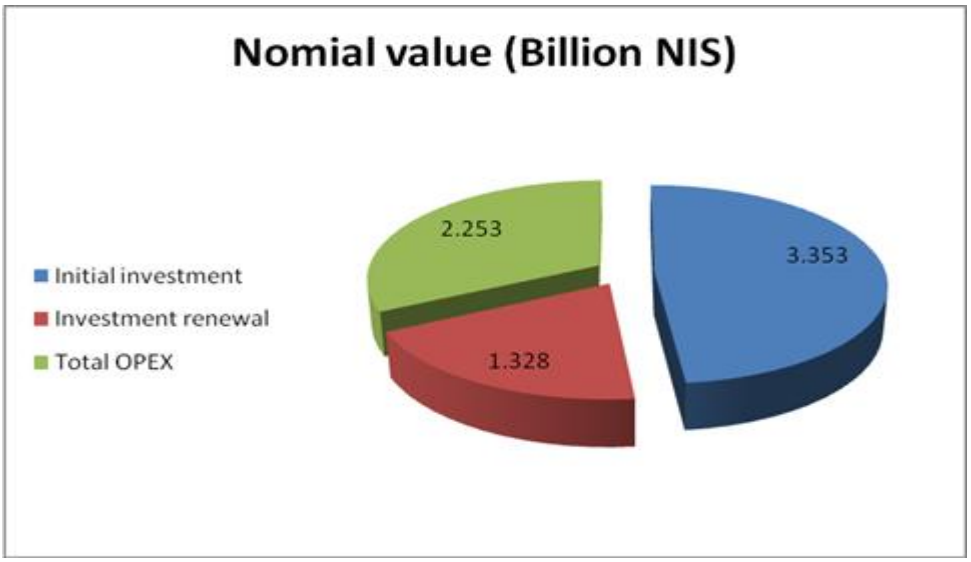
In the current report we assess (a) the incremental costs and benefits of enhanced smart metering from (b) a national point of view. An incremental analysis implies that all the costs of the business-as-usual scenario (BaU) over the horizon of the CBA will be subtracted from the costs of the enhanced smart metering deployment scenario. A national reference point implies that we calculate to what extent an investment in enhanced smart metering increases total social welfare (the size of the pie), with no reference paid to the issue of how this welfare gain is distributed (the size of each slice). To conduct the actual assessment, in lack of Israeli data, we have benchmarked costs and benefits against 20 national CBAs and more than 70 reports and research articles on pilots, technology trials and smart metering in general.

Costs of enhanced smart metering

In nominal value, the total costs of an enhanced smart metering deployment are 6.934 Billion NIS. Figure 1 displays a high level of these costs, divided into CAPEX and OPEX. Total CAPEX of enhanced smart metering is 4.681 billion NIS, sub-divided into (a) initial investment (3.353 billion NIS) and (b) investment renewal (1.328 billion NIS). Smart meters and communication is the most significant post internally (46%). Total OPEX of enhanced smart metering is 2.253 billion NIS, with data transmission as the most significant post internally (48%). CAPEX is more significant than OPEX since it includes both (a) the initial investment (3.353 billion) and (b)

renewal investments (1.328 billion).

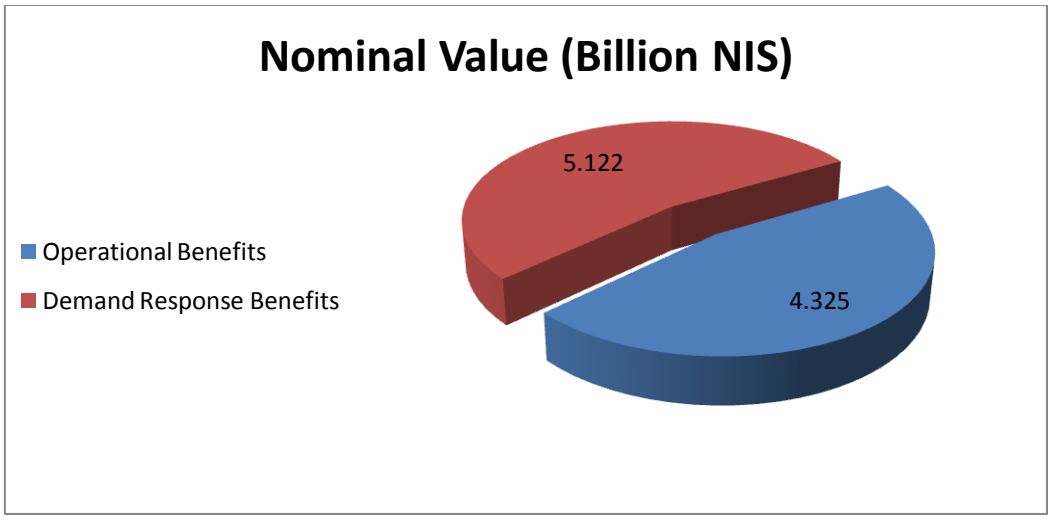
Figure 1: High level overview of CAPEX and OPEX



Benefits of enhanced smart metering

The total benefits of enhanced smart metering are 9.447 billion NIS. Figure 2 displays a high level of these benefits divided into Operational Benefits and Demand Response Benefits. Total Operational Benefits of enhanced smart metering are 4.325 billion NIS, with information benefits as the most significant post internally (47%). Total Demand Response Benefits of enhanced smart metering are 5.122 billion NIS, with consumption reduction as the most significant post internally (51%).

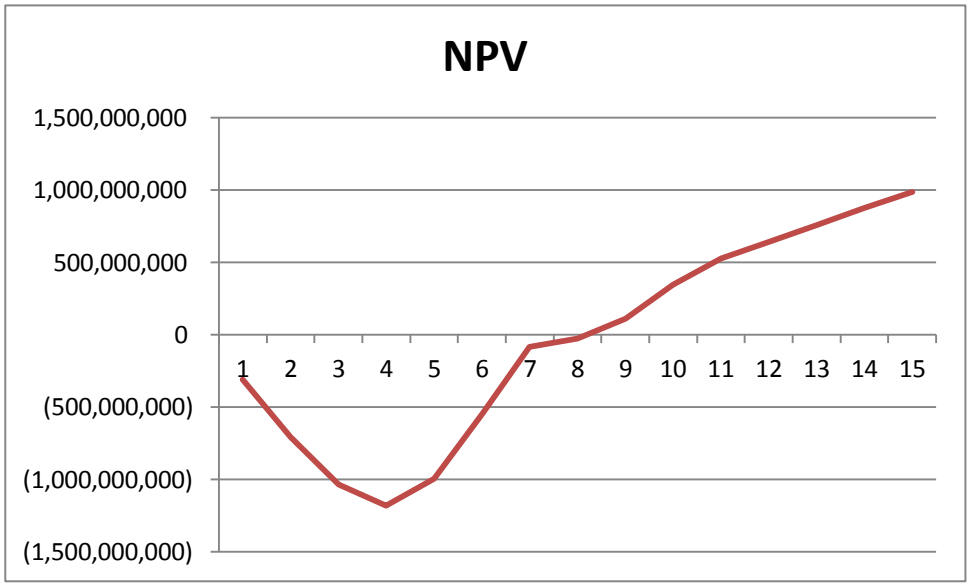
Figure 2: High level overview of Benefits



Main results

Over the 15 years time horizon of this CBA, enhanced smart metering deployment in Israel has a net benefit of 986.73 million NIS. Figure 3 displays how this NPV develops in time given the discount rate of seven percent. After the Initial IT CAPEX (407 million NIS) is completed after three and a half years, NPV shows a constant positive slope. In the fifth year there is a kink in the graph resulting from the deferring investments of a new power plant[1]. In the ninth year we get the first positive NPV.

Figure 3: NPV 2015-2030 given discount rate of 7%

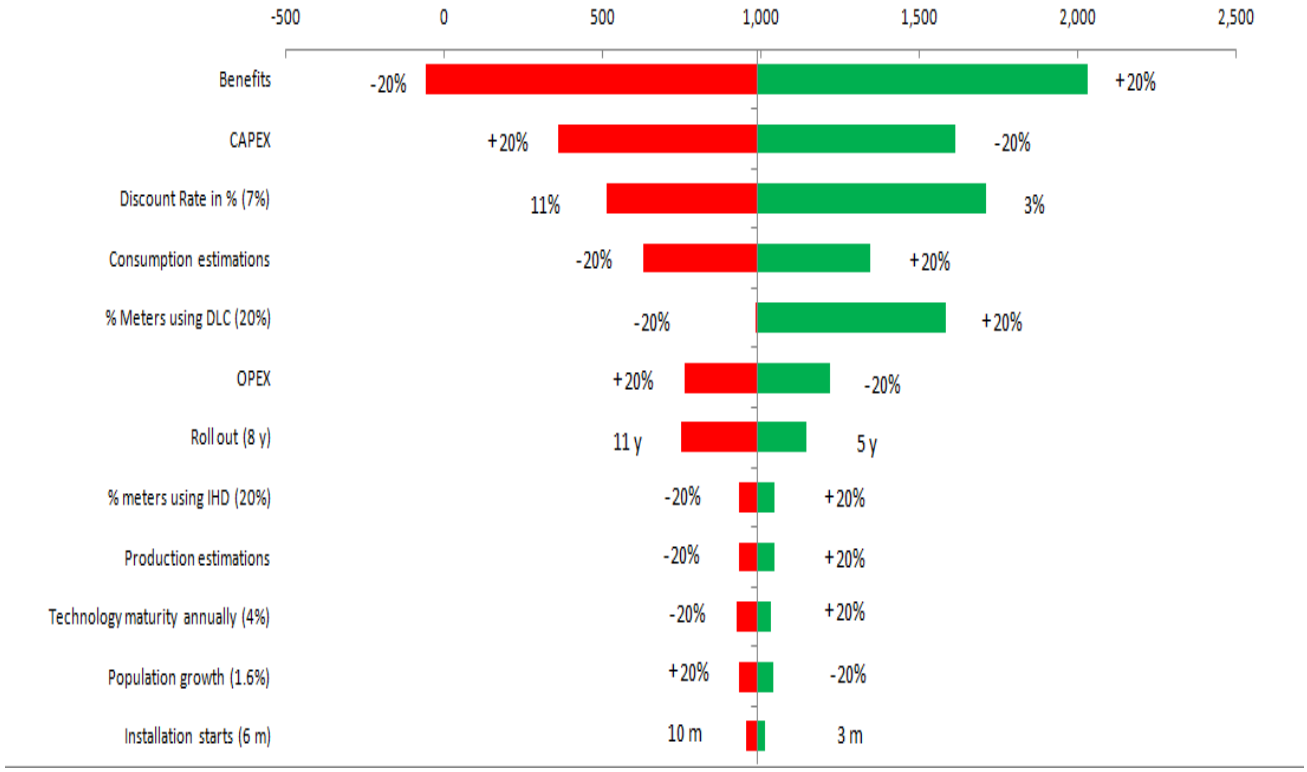


Sensitivity analysis.

From figure 4 we see that the NPV is most sensitive to changes in (1) benefits, (2) CAPEX, (3) discount rate and (4) consumption estimations. The positive NPV remains robust across a range of sensitivity tests carried out. A reduction in benefits of 20% is the single parameter with a potential of turning the NPV marginally negative. It is worth noting that the NPV would still be highly positive should the CAPEX of enhanced smart metering be 20% higher than what we assumed.

[1] The benefit is spread over three years with a 20%, 40% and 40% distribution respectively.

Figure 4: Sensitivity Analysis, changes in NPV



7. The Israeli industry engagement

The global focus on cleaner energy and energy efficiency has become a key driver for smart grid which is an integration of the Energy and Telecommunication systems. This turns SG to be a perfect solution for the evolution of the high tech industry.

The Israeli high – tech and electronic industry has more than 2000 companies who can provide services and products to the smart grid project, leveraging the country's strong base in semiconductors, power electronics, communications,

The industry has to take action and to learn:

- The specific requirements of the energy system.
- The international standards ,
- The current available products ,
- The profiles of energy customers and their market needs
- The business advantage combined with risk analysis.

Based on the results each company can:

- Analyze the profitability of adapting its product line to the Energy sector.
- Establishing the local operation.
- Recruit the funding by VC or others.
- Go international.