INITIAL COMMENTS OF HONEYWELL, INC. ON POLICY AND LOGISTICAL CHALLENGES IN IMPLEMENTING SMART GRID SOLUTIONS

Pursuant to DOE's September 17, 2010 request, Honeywell, Inc. ("Honeywell") respectfully submits these comments on policy and logistical challenges and potential solutions for implementing Smart Grid solutions. Honeywell appreciates the opportunity to comment on regulatory policy issues that need to be considered, and on implementation challenges and opportunities critical to deploying Smart Grid systems.

We base our views on Honeywell's market-leading position and over 100 years of experience in providing energy management solutions. Nearly 50% of our product portfolio delivers energy efficiency benefits. Honeywell Automation and Control Solutions division has completed more than 5,000 energy efficiency improvement projects for schools, cities and other government entities; these projects have delivered more than $4.5 Billion in guaranteed energy and operational savings. Honeywell is one of the original partners of the Clinton Climate Initiative to bring these energy efficiency programs to government buildings in major cities around the world. Honeywell energy management technologies are found in more than 150 million homes, five million buildings, 24 of the top 25 refineries, and nearly 5,000 industrial sites around the world. By applying our expertise in sensing and controls, we are creating energy efficient, more comfortable, safer, more secure and productive environments for our customers. For example, home owners typically reduce their heating and cooling demand by up to 30 percent using Honeywell's programmable thermostats. If Honeywell's energy efficiency technologies were immediately and comprehensively adopted, we could substantially reduce US energy demand by 20-25%.

In more than 25 years of working with the nation's utilities, we have deployed over a million one-way communicating demand management devices in homes, including switches to cycle air-conditioning and communicating thermostats; these help lower peak electricity load by more than 1 GW across the nation while maintaining consumers' comfort and reducing their electricity bills.

For this RFI, Honeywell has chosen to provide our broader point of view, rather than address each question separately. We have listed the relevant RFI category below each topic. As DOE considers policies associated with adoption and deployment of Smart Grid technologies, Honeywell stands ready to offer its expertise and experience.

A. COMMUNICATIONS

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B. OVERVIEW: Smart Grid Design Principles

Smart grid adds measurement, communication and controls layers on top of the nation's power grid to enable optimization of the entire energy value chain from generation, transmission, distribution to consumption. The following principles should be considered across all stakeholders when designing and implementing Smart Grid policies:

Consumer Empowerment – Empower consumers by providing information and enhancing their ability to control their energy consumption.

Affordability – Provide cost-effective smart grid solutions by utilizing existing measurement, communications and controls infrastructure, whenever practical, to ensure best use of taxpayer and ratepayer dollars.

Security and Privacy – Communicate smart grid data and information securely, privately and in a timely manner.

Energy Efficiency and Conservation – Incentivize efficiency and conservation for utilities as well as consumers (residential, commercial & industrial). Energy efficiency is the lowest hanging fruit and the first fuel in achieving energy security for the nation. Smart grid technologies have the capability to maximize energy efficiency.

Renewables, Distributed Generation and Electric Vehicles -- Enable integration of renewable and distributed generation with the power grid. Provide seamless grid connectivity to Plug-in Electric Vehicles (PEVs) which also have capability to provide mobile energy storage for balancing the grid.

Future-proofing – Ensure emerging technologies and evolving customer needs do not strand current assets.

To ensure long-term benefits of Smart Grid, the needs of all stake-holders should be considered in developing and maintaining a detailed roadmap. The roadmap should address all value-chain elements, and ensure efficient operations across the life-cycle of both the utility-side as well as the end-user side of the electricity infrastructure. Continued federal and state funding for research in scalable technologies will be critical to Smart Grid success.

C. Policy Considerations in Smart Grid Design and Deployment

1. Consumer Empowerment: Information and Control for Home Owners

RFI Categories: *Interactions with and Implications for Consumers; Interaction with Large Commercial and Industrial Customers*

Today, residential consumers get electricity bill once a month. However the smart interval meters being deployed as part of smart grid are capable of recording energy consumption data at much finer granularity. Making this data available to customers will empower them to make smart choices about energy consumption. In particular, smart grid policies should encourage the following principles,

- Provide near-real-time energy consumption data to consumers so they can understand where energy is being spent and make necessary behavior changes to conserve energy and lower their utility bills.
- Let electric utility rates reflect true-cost and nature of electricity generation and transmission so consumers can benefit from shifting their flexible loads to time periods when electricity is cheap.
- Encourage deployment of easy-to-use automatic controls for consumers to program their preferences and let automation provide complete, consistent, and persistent energy savings.

This approach has produced tremendous benefits for commercial and industrial consumers. Most large C&I customers sign up for variable electricity rates such as time-of-use, CPP, etc. They have also invested in interval meters. These meters provide near-real-time information about energy consumption directly to the energy management system at the consumer premises. The analysis of such detailed consumption data produces valuable information enabling behavior change. Embodiment of these “smart” policies in on-site energy manager results in energy savings and reduced bills. For example, Honeywell’s Novar business unit has helped large retailers achieve 20 - 40% improvements in energy efficiency and maintenance costs and 10 - 20% reduction in peak load.

The same design principle can be used for providing benefits to residential consumers.

2. Affordability: Use of Existing Infrastructure, Encouragement of Open Markets

RFI Category: *Assessing and Allocating Costs and Benefits*

Giving consumers direct access to their smart-meters with standard communication protocols is the simplest and most cost effective way to proving near-real-time energy consumption data as described above. Smart Grid policies should advocate cost-effective solutions that avoid the potential for obsolescence. For example, the Smart Grid communications should utilize existing communication infrastructure wherever possible using the following principles:

- *Separate the flow of electric power from the flow of information:* Ratepayer financed investments in Smart Grid should be limited to those tasks currently managed by the utility – measurement of aggregate power usage for billing and operational purposes. Currently, billing data is collected by the utilities once a month using drive-by or physical meter reading at customer premises. As AMI networks get deployed, they should be sized to provide "just enough" bandwidth for meter reading a few times per day (as many times as the smart grid tariff changes). Existing communication networks, (e.g., cellular, broadband, municipal WiFi) can support the rest of the smart grid communication needs with adequate reliability, data privacy and security. Separating the information and electricity flow in this manner allows the grid to become increasingly smarter without the need to continuously change the metering infrastructure (which has a long and more expensive replacement cycle).

- *Utilize existing commercial communication networks to eliminate unnecessary smart grid costs:*
  Existing commercial communication networks are extremely reliable, highly robust and are used today for many applications that demand high bandwidth, privacy and security (e.g., video transmission, internet banking, on-line purchases, tax return filing). These networks are actively managed by the telecom utilities and utilizing them for smart grid will avoid large network and IT infrastructure investment at the power utilities, thereby resulting in cost effective smart grid solution for the ratepayers.

- *Encourage an open market to enable low cost innovative products:* The consumers of new technologies should be the ones who decide which technologies are the winners. Therefore, public policy should encourage an open market participation, which, in turn, will encourage innovation and investment in new technologies. Competition will ensure availability of better and cheaper products, similar to the telecommunications market - innovation and competition have made cell phones and cell phone services very affordable even to low-income consumers.

3. Security and Privacy: Consumer Control and Ownership of Consumption Data

RFI Category: *Reliability and Cyber-Security*

The power grid is a critical infrastructure for the nation and as such should be protected from potential physical and cyber attacks. Cyber security should be a key consideration starting from the design phase of the smart grid. Two key documents outline guidelines for building a secure smart grid – namely the NERC CIP and NISTIR 7628. These guidelines should be followed during smart grid deployments.

Grid security applies to three different areas:

- Securing customer data,
- Securing utility systems including generation, and,
- Securing T&D equipment and information

Generation, T&D and AMI networks should be maintained as distinct communication systems so that it will not be possible to access one system from the other.

Detailed consumption data describes a customer's living or business pattern, including occupancy at the customer's home or business location. This data is essential for optimizing energy use and cost, hence it should be made available to on-premises devices. The consumer owns this data and should have access to it, and should control how this data is made available outside customer premises. This principle minimizes transmission and storage of such sensitive data at a central database thereby minimizing probability and severity of cyber threats.

In summary, to ensure data privacy, security and integrity, we need to:

i) Minimize the amount and sensitivity of data sent to the utility by restricting the granularity of data passed from the meter to the utility.

ii) Protect the data in transit.

iii) Apply strict privacy policies which limit how the utility may process the data and who they may share it with. No customer data should be shared outside of the utility unless the customer explicitly opts in to a sharing program.

Three elements will ensure data security for the consumer premises:

Firewall**:** Smart grid architectures should incorporate a bi-directional firewall between the home and the meter. This firewall will protect the utility from hostile activity originating in the home area network (HAN). The firewall will also protect the home area network from intrusion via the AMI network.

Cryptographic security mechanisms *for the home area network*:

- Prevents eavesdropping on the data in the home area network.
- Prevents attackers from gaining unauthorized access to the home area network.

Internet Gateway: If a gateway or router is used in the customer premises, it should prevent ports opened for energy management traffic from compromising either the home area network (energy management) or the home data network (PC). For example, ports on the internet gateway/router may be opened to allow a third party to perform direct load control via the internet. Firewall and cryptographic mechanisms must be employed to prevent an attacker from gaining unauthorized access to the home area network or home data (PC) network via these open ports.

4. Energy Efficiency & Conservation: Incentivizing Utilities and Consumers

RFI Categories: *Assessing and Allocating Costs and Benefits; Utilities, Device Manufacturers and Energy Management Firms*

Initial investment on the consumer side of the smart grid, fueled by ARRA stimulus funding, was focused on smart metering infrastructure providing the foundation of the Smart Grid. While AMI networks enable optimization of utility operations (meter readings, remote connect/disconnect, outage detection & restoration, volt/var control), much larger energy efficiency savings (including peak load reduction, load shifting, etc.) can be achieved by deploying Smart Grid-enabled control systems in the consumer premises. The following principles will ensure that incentives for utilities and consumers are aligned to produce energy efficiency and emission reduction benefits for everyone in the society:

- Incentivize utilities to invest in producing negawatts and negawatt-hours: Investor-owned-utilities are typically incentivized to invest in capital assets for increased generation or T&D capacity. Smart grid policies should provide incentives for utilities to invest in customer premises equipment that produces energy efficiency and reduces peak load. Utilities should also be incentivized to use existing communication infrastructure instead of building new smart grid communications wherever possible.

- Provide consumer incentives for energy conservation: If electricity rates reflect true cost of generation and transmission, there will be an incentive to save energy and shift load from peak to off-peak times. Deploying variable electricity rates will be an effective mechanism to reduce peak and base consumption. Variable rates should be implemented while protecting lower income consumers by using various forms of rebates and subsidies.

5. Renewables, Distributed Generation and Electric Vehicles: Solving grid integration challenge using Demand Response

RFI Category: *Long Term Issues: Managing a Grid with High Penetration of New Technologies*

Grid stabilization and frequency regulation is traditionally accomplished by varying electric generator outputs to match electric loads. However, electricity produced by wind turbines and solar photovoltaic systems depends on weather and hence can not be scheduled. This creates a challenge for grid integration of wind and solar produced electricity. Typical approaches to renewable integration include using grid scale storage (batteries, pumped hydro, compressed air) or fossil fuel peaker plants alongside wind/solar farms. The first approach above is still very expensive, and the second approach defeats the purpose of using renewables in the first place. While storage technologies are still maturing, demand side management could be used for grid stabilization with variable output renewables.

Demand-response technologies are currently used in both residential and C&I sectors, mainly for peak load management within available system capacity. Some applications of DR are also being used for grid stabilization, e.g., Hawaii electric's use of DR for electric water heaters. New technologies that automate demand-response using the OpenADR protocol are being developed and tested in California. This automated DR functionality will make demand side management a viable near-term option for renewable integration. Smart grid policies and R&D investments should encourage use of automated DR and Fast DR for grid stabilization and renewable integration. Policies should also facilitate the use of Plug-in Electric Vehicles (PEV) especially utilizing their distributed storage capabilities.

6. Future Proofing: Cybersecurity and use of Internet Protocol

RFI Category: *Reliability and Cyber-Security*

Future-proofing is essential to ensure assets are not stranded. This is best enabled by:

i) Promoting and adhering to the standards currently being developed by leading organizations (NIST, CERT).
ii) Establishing clear demarcation points in information flow.
iii) Implementing an architecture that supports innovation and cost-competitiveness with minimal dependence on costly and rigid infrastructure elements.

We provide two specific considerations for future proofing:

(1) Include cyber security considerations from the initial design stage – especially sizing of computation power and memory in embedded devices to implement adequate cryptography and authentication methods.

(2) IP based networking – Internet protocol has provided the backbone for modern communications for over 4 decades. This is a great choice for designing future-proofed networks and should be followed in Smart Grid communications.

D. Harmonization of Smart Grid Design

RFI Category: *Definition and Scope*

Achieving Smart Grid goals should transcend geographic boundaries – we envision an interoperable system that works across utilities, is under the purview of the state government, and allows regional ISOs to source electricity optimally. In the long term, we envision Smart Grid technologies improving the management of natural gas and water as well.

Standards are critical to ensure interoperability and safety of Smart Grid components. NIST is currently driving seminal standardization work – all Smart Grid players including vendors, utilities, ISOs and aggregators should comply with NIST standards as soon as they are approved.

A global perspective on standards is needed to ensure compatibility across US, Europe and emerging markets. While the specific communication protocols or physical abstraction of Smart Grid functionality might be region-specific, the underlying data models and architecture should be harmonized across global markets. This will facilitate cost-effective solutions being deployed with minimal regional customization.

In-home technologies, communication protocols, device drivers and use-case semantics will all evolve over time. The Smart Grid system should scale both in user reach and technology breadth, and allow seamless “plug and play” of energy consumption, generation, monitoring and optimization devices. Interoperability and standards are key to achieving this vision, and so is the ability to communicate across the different components in the Smart Grid.

Consumer and retail Smart Grid products should adhere to standards – this will allow components to be used across the nation, without customization for each state or PUC. We understand that state and regional variations may be needed for utility-end (head-end) solutions, based on the specific go-to-market strategies in the state. These applications, for example auto DR, will need to be customized, but should be built on a re-usable common set of technologies.

E. Increased Customer Awareness

RFI Category: *Interactions With and Implications for Consumers*

Although many electricity industry personnel refer to the Smart Grid and have a keen understanding of the benefits, the majority of consumers do not. Engaging customers is an important facet in program success. It is important to understand the drivers for each customer segment – cost, comfort or “green”. The information presented and the technologies selected should reflect these drivers – this helps to drive program understanding, participation and results.

Engaging consumers will be a balance of education, ongoing incentives and simple choices during initial participation. For example, migration from OPT-IN to OPT-OUT in demand response programs can change results dramatically. Even in an OPT-IN situation, participation results can vary from slight below 10% or soar to greater than 30% when there is a tailored education program.

Experienced deployment vendors and robust marketing programs are other important criteria. From our experience, the marketing plan should go beyond a typical Public Service Announcement. We need to run a structured campaign that demonstrates savings through pilots, and involves utilities, ISOs and consumer organizations (e.g. NASUCA) in providing data-driven facts to customers. Clear articulation of customer value, intuitive user interfaces on energy management devices and good customer interaction are critical for marketing campaigns to succeed. Finally, success stories of energy savings should be disseminated widely.

F. CLOSING SUMMARY: Smart Grid Technology and Policy Considerations

Initial ARRA investment covered smart metering and T&D infrastructure improvements. Additional investment will be needed to create and sustain consumer benefits.

Smart Grid policies should accelerate customer adoption, acceptance and validation of energy saving measures. We propose DOE work with federal and state agencies in considering the following policy recommendations:

Enable Consumers to Realize Financial Benefits:

- Enable real-time access to consumption information as the key enabler for behavior modifications.
- Facilitate consumers to utilize variable electricity rates (TOU/CPP) to modify behaviors and decrease their electricity bills.
- Encourage context-aware automation to maximize consumer savings with intuitive easy-to-use automation solutions.

Converge on Customer-oriented Smart Grid Architecture

- Establish clear demarcation point between the utility and consumer premises.
- Ensure ownership, access and control of consumer data in a secure manner.

Create Compelling Value Propositions for Utilities

- Incentivize utilities to promote negawatts rather than build megawatts.
- Encourage use of existing communications infrastructure to ensure best use of ratepayer dollars.
- Encourage the adoption of Demand Response as an essential prerequisite to the widespread use of renewables.