SECTION 7: Demand Response Business Issues

I. INTRODUCTION

Each morning millions of CEOs around the world wake up wondering if their business is on track to meet its goals. It doesn't matter if the firm is Deutsch Telecom, General Electric, or the local florist. All businesses have goals. The size of the firm, its product portfolio, and target market will help dictate what those goals are. Of course, the local florist will have more modest expectations than a multinational corporation like Deutsch Telecom would. Nonetheless, both CEOs are constantly evaluating their market position, considering product structures, and contemplating strategies for overcoming potential market barriers.

The emerging demand response marketplace is not immune to these thought processes. CEOs in the energy industry, and their team members, are wondering what demand response means to them. Is it a business strategy that they should consider pursuing? If so, how should they proceed? They will also wonder how their firm's DR capabilities fit in the marketplace relative to other market actors. Answers to these questions will help the business develop a business plan for the DR market. The business plan should focus on identifying how they can exploit their relative strengths and mitigate their relative weakness. It should also describe the type of services that they intend to provide with an estimate of the future revenue and costs from those services. Finally, the business plan should identify obstacles that may impede the ability to achieve the desired goals.

This chapter will explore the following key business issues related to the demand response industry:

> **DR Business Models:** This section will discuss opportunities and challenges facing the various market actors involved in demand response industry.
>
> **DR Products:** This section will discuss a variety of DR product designs and highlight a few products in use today.
>
> **DR Market Barriers:** This section will identify many key, and common, market barriers that are hindering the growth and adoption of DR.

II. DR BUSINESS MODELS

A business model can be defined as the manor in which a business provides a product or service to a consumer. In this context, the business must identify who their target customer is and/or should be, how the business will produce the product or service, and how the business will earn a profit from its efforts.

The number of business model permutations is limited only by the creativity and strategy of a business' leadership team. For example, some businesses are structured such that they make a product and sell it directly to a consumer. For example, vertically integrated electric companies produce power and sell it to the ultimate consumer. However, there are a variety of indirect models that can also be profitable. For example, Google, a major internet search engine, earns most of its revenues from selling targeted advertising space to other businesses as opposed to charging the person using the search engine. Both of these examples are strong, viable business models. They approach their respective markets in different ways, but they have a clear strategy for product development, sales, and business profitability.

There are also a variety of business models in the demand response marketplace. In general, the chosen business model tends to be driven by perspective of the market actor. For example, an Energy Retailer may offer DR services in order to help manage its own supply portfolio. Whereas, an Energy Service Company may believe it's in a unique position to offer DR services given that they have the ability to monitor and control certain consumer loads. Both of these firms are certainly in a position to offer DR services, but they would likely take different approaches given their market perspectives.

In order to construct a DR Business Model, one must consider (a) who the market actor is, (b) what motivates the market actor to participate, and (c) how does the local market structure work.

A. Market actor description

In order to understand what DR means to a particular market actor class, it is helpful to first review the market actors. Chapter 3 of the Project Guidebook identified the following DR market actors:

> **Participating Consumer:** By definition, demand response is a resource provided to the grid by end use consumers. The consumer can provide the resource via selling back "unused power", activating onsite generation, or participating in a real time pricing cost structure.
>
> **Local Distribution Company (LDC):** These firms tend to be natural monopolies responsible for distributing power to the local community. Depending on the market structure, this entity could be vertically integrated (e.g. owns generation and sells commodity) or they may just be responsible for the distribution wires network.
>
> **Energy Retailer:** This firm is responsible for the procurement and scheduling of electric commodity for its customers. Again, depending on whether the market is liberalized or not, this responsibility could be included in a vertically integrated firm or it may be a stand alone retail marketing firm.

Demand Response Service Provider (aka DR Aggregator): In many cases, the DR Service Provider will be either the LDC or an Energy Retailer. However, the growth of the demand response industry over the last few years has yielded a new breed of third party entities. These firms aggregate DR capacity by entering into contract with the participating consumer. In some cases, the aggregators have bilateral agreements with the LDC or Energy Retailer to market and manage DR activities. In other cases, these firms are able to aggregate the DR capacity and offer it directly into the wholesale power market like any other generation resource.

Energy Service Companies: These firms provide DR technologies that enable DR capacity. By their nature, these firms market and sell products and services that can help the participating consumer manage, monitor, and activate DR capabilities. Many of these firms have also expanded their service offering to include the DR Service Provider role as well.

System Operators: The system operator is responsible for managing the transmission system. They are normally chartered to ensure a safe and reliable level of power. In some cases, the system operator also manages a formal wholesale power exchange. In other cases the wholesale power exchange is a separate entity. It should also be noted that many markets do not have either of these formal institutions. In these situations, grid management and power "trading" are handled bilaterally with some type of regional operating agreement/rules.

There are two other categories that should be noted: Regulators and Society. These entities may not be direct DR market actors but they can influence the development of DR markets or are beneficiaries of it.

Regulators: Regulators are an important market actor because they set policies that the industry must abide. However, it would be unlikely that they would have any direct involvement in DR business models.

Society: It is important to recognize Society as a market actor when discussing DR. Society will almost certainly be an indirect beneficiary of DR by way of lower total energy costs.

B. Market actor motivators and challenges

The next thing to consider is how the market actors can benefit from DR activity and the challenges they must consider when doing so. Concepts originally outlined in Chapter 3 are incorporated and expanded here.

Participating Consumer:

Benefits: The participating consumer is the entity that actually provides the demand response. This entity generally benefits from direct financial reward for participating during a given event and the reduction of energy that would have normally been consumed during the event. The financial reward could be some percentage of the energy market price, a regular capacity reservation

payment/call option, a reduction in energy rates, a combination of the above, and/or some other structure. The point is that they are generally provided with some incentive to earn their participation. However, there is also a growing interest by many consumers to participate in DR efforts simply because it is a good thing to do as a "corporate citizen". In this case, they may be willing to forgo financial rewards in exchange for the image it bestows on the firm as a good community partner.

Challenges: The consumer will ultimately weigh the benefit of participation with the costs and responsibilities for doing so. In other words, the consumer may compare the benefits they receive with the costs they may incur such as labor expense, technology costs, opportunity costs/production downtime, and relative comfort.

Subcategories:
Participating Consumers can be subdivided into three groups: (a) Large Commercial & Industrial, (b) Small Commercial & Industrial, and (c) Residential. However, it is important to note that each of these categories can be further refined to discrete industry levels (e.g. chemicals, pulp & paper), commercial operation (e.g. office building, shopping center), and residential type (e.g. high rise condo, single family home)[1]. A number of strategies for engaging consumers in the three categories noted above are listed at the end of Chapter 6.

Given that the Participating Consumer comes in many difference shapes and sizes, it can be helpful to consider the types of things they will consider when deciding whether to participate in a DR product.

a. Large Commercial & Industrial

1. Typical DR Participation Methods
   - Load shedding
   - Onsite generation
   - Commodity price structures (i.e. RTP, TOU)
   - Automated load control

2. Consumer Motivations

These consumers are typically very sophisticated energy users and buyers. They tend to understand how, when, and where they use energy. Energy also tends to be a significant line item expense in their operating budget. Furthermore, assuming local market rules allow, they tend to shop for the best energy supply arrangements that they can find.

[1] Identifying specific DR strategies for discrete types of participating consumers is beyond the scope of Task XIII. However, a consortium of European firms commissioned a project called EU-DEEP. This project surveyed a large sample of consumers to identify the type of specific DR activities consumers within each standardized industry code can perform. Unfortunately, the results are proprietary, but additional information can be located at www.eu-deep.com .

As such, these consumers are generally willing to reduce consumption and/or activate onsite generation when it is appropriate to do so provided that (a) they are fairly rewarded for their efforts (financially and/or emotionally – "good corporate citizen"); and (b) the reward should be greater than the direct costs they incur to participate.

The consumers in this group are generally considered to be the easiest to enroll in a DR product given that they can identify specific actions they can take to reduce their need for grid power. However, since they are sophisticated consumers and they can generally provide large DR capability at each location, they will likely seek very competitive offers for their DR resources.

b. Small Commercial & Industrial

1. Typical DR Participation Methods
    - Load shedding
    - Commodity price structures (i.e. RTP, TOU)
    - Automated load control

2. Consumer Motivations

These consumers tend not to be as sophisticated as the larger consumers. In their case, energy may be a big line item expense, but it may not be one of their most critical business issues. Therefore, it is important to them, but they generally don't focus significant time and effort to manage it.

Nonetheless, every energy dollar that these consumers save tends to fall directly to their bottom line profitability. Therefore, they are generally willing to participate in a DR product provided that they can develop a proper participation strategy.

As a result, the key to reaching these consumers tends to be related to education and service. These consumers need help with understanding how the DR market works, how they're able to participate, and how they can benefit.

It should be noted that this higher degree of service tends to have higher sales and marketing costs associated with it relative to the DR MW provided. Therefore, the DR Service Provider needs to consider these additional costs when they develop their business case. On the other hand, they may also be able to receive greater margins for the additional service provided.

b. Residential

1. Typical DR Participation Methods
    - Commodity price structures (i.e. RTP, TOU)

- Automated load control

2. Consumer Motivations

Residential consumers tend to be the least sophisticated energy buyers. In fact, the vast majority of residential consumers probably do not even know what DR is. Nonetheless, they have demonstrated a strong willingness to participate in a variety of load control tariffs (e.g. AC, electric heat, electric water heaters, etc). These consumers may sometimes receive a small bill reduction or rebate for participating in these products, but it has also been shown that they will participate without financial benefit because it is good for the community.

Local Distribution Company (LDC):

Benefits: LDCs have benefited from DR by including it as a way to improve grid efficiency and/or utilizing its distributed nature to surgically target specific distribution challenges (e.g. deferral of substation development, distribution system congestion). DR can be one of, if not, the most inexpensive resources, so it provides an excellent hedge to "high cost, but low frequency" events (e.g. top 100 hourly prices). Some LDCs have also used DR as a strategic resource to defer the development of new substations. If properly implemented, this strategy can shave years off of costly upgrades thereby improving the overall financial performance of the firm.

Challenges: If the LDC is a pure wires company, they may not have the retail sales staff needed to properly market a DR product. DR is a product that must be properly communicated to consumers. It may prove difficult to do that without a properly trained staff.

Energy Retailer:

Benefits: The Energy Retailer is in a great market position to offer DR services to their clients. The energy retailer can benefit from DR by including it as a resource in their supply portfolio. This could help them have an overall lower operating cost, which allows them to be more competitive and ultimately more profitable in the market. They can do this by improving accuracy of their daily supply bid schedules and/or using the resource in their reserve portfolio. Many retailers also use DR as a customer acquisition/retention tool. By offering the service to their customers and prospects, they are enhancing their product portfolio and increasing their attractiveness to consumers that wish to provide the service.

Challenges: In order for this strategy to be successful, the Energy Retailer must be committed to making it so. Often, this means a serious financial commitment to metering, meter data management systems, DR event management systems, and related staffing levels. Unfortunately, since most liberalized markets are relatively new (10 years or less), many of these firms have been focused on commodity service management and marketing. They

generally see the benefit that DR can provide and many are taking advantage of those opportunities.

Demand Response Service Provider (aka DR Aggregator):

Benefits: In some markets, there are firms that have entire businesses built around aggregating consumer demand response capability and offering it into the energy market along side supply side options. Since DR has a relatively low operating cost when compared to other peaking sources (e.g. combustion turbine), these firms are able to operate "virtual power plants" with lower operating expenses. They also tend to provide other services to their customers in conjunction with or as an Energy Service Company.

Challenges: One of the biggest challenges facing the DR Service Provider is selecting target markets that will yield a predictable cash flow. Some of the most successful markets in attracting these firms tend to have a way that the DR Service Provider can forward sell the asset. For example, Norway has a reserve option market in which a service provider can sell into daily. In addition, some markets in the United States have capacity payments. It is a little more risky and complicated if the business plan is only built on Energy Only payments. The risk is that if there are no events in a given year, the supplier and consumer will not earn any revenue. On the other hand, there is a DR Service Provider in Australia that has found ways of structuring bilateral agreements with an LDC or energy retailer even though it is an energy only market. By doing this, they have mitigated some of the event opportunity risk.

Energy Service Company:

Benefits: This market actor provides energy related products and services to consumers (via the LDC/Retailer or directly). Many of these products and services can be used to provide DR capacity/performance. This could include things such as control systems to manage equipment and/or lighting, energy audits to assess facility level DR implementation strategy, and on-site generation installations and maintenance, just to name a few. These firms benefit from DR markets from increased utility for their services and improved project ROI.

Challenges: DR technologies need DR markets. There are a wide range of technologies that can enable DR capacity, but if that capacity is not valued by the market the technology must build its business case on improving facility efficiency. Of course, this is not necessarily a bad option. It just means that they will not receive additional revenue from DR that can help improve the equipment payback hurdle.

System Operators:

Benefits: System Operators are generally charged with ensuring grid reliability and fair markets. Demand response, by its very nature, can directly assist with both of these issues. First, DR is a distributed resource. With proper market

rules, incentives, and infrastructure, system operators can use demand response to strategically address system reliability issues such as congestion. ISO-New England has been utilizing this approach to help deal with transmission congestion problems in Southwest Connecticut, one of the most congested zones in the entire United States. DR provides them with a callable resource inside the load pocket that they can activate when needed. In addition, as noted previously, DR can impact demand elasticity thereby causing more efficient market pricing. Statnett, the Norwegian system operator, has also developed a way to incorporate DR resources into its reserve markets.

Challenges: Demand response requires a fairly high level of coordinated precision among multiple entities within what is normally a tight time interval. This means that a System Operator may have to integrate new communication and meter data systems. However, some system operators would prefer that DR be developed and managed at the retail level. They are willing to work with the market to establish proper business rules for DR inclusion in the appropriate markets, but they do not desire to have business relationships with multiple retail consumers.

Regulators:

Benefits: Regulators tend to seek solutions that benefit society (i.e. reduced costs, increased security of supply, reduced environmental impacts, etc) and reduce market power. DR has shown to provide lower energy cost when properly utilized by impacting demand elasticity. This same trait helps to mitigate market power that supply side bidders may have during peak pricing events. Therefore, regulators generally receive positive marks from consumers for promoting DR.

Challenges: Most regulators have a record that demonstrates their desire and interest in promoting DR activity. However, their challenge seems rooted in identifying ways to promote DR in the new institutions when it was not originally designed to support it.

Society:

Benefits: Each of the other categories discussed DR's impact on a specific type of firm or organization. However, it is important to recognize that society as a whole benefits from DR by reducing the overall cost of energy supply. This can be good and potentially bad at the same time. The value that any individual participant receives, whether it's the consumer, the utility, a retailer, excreta, will establish the basis for their interest level for participating.

Challenge: It may be easily demonstrated that robust demand response in a given marketplace can have dramatic impact on societal energy costs, but if individual actors do not receive the proper incentives to participate the societal benefits may be lost. In economic circles this is known as the "tragedy of the commons".

C. Market structure impact on business models

1. Energy Only Markets

Some markets such as Sweden and Australia operate on an energy only basis. In these markets, the total cost of supply is reflected in the prevailing energy price. These markets have expressed a desire to incorporate DR because it provides a built in market trigger to balance market power situations. Their challenge, however, is to find a way for DR aggregators to have enough certainty in future revenue streams that they are willing to enter the market.

Right now, the biggest concern in Sweden, and in many of the participating countries, is that the market prices have not yielded a high enough level long enough to attract participation. This is both good and bad. It's good in that this means that energy prices are relatively low and new capacity many not be needed. On the other hand, it's bad in that they recognize the need for future capacity and understand that while DR may be the lowest cost peaking resource it will not be available if it is not nurtured. Sweden's Market Design project is currently evaluating multiple business model solutions to deal with this challenge.

One Australian aggregator is working on a way to get around the revenue certainty issue in an energy only market. The specific details are confidential, but it is believed that they are selling the equivalent of call options to the local distribution companies and/or the energy retailers on a bilateral basis. This provides them some revenue certainty for low to no-event years, while positioning them to have the proper capacity when it is actually needed.

Energy Only markets are probably the most pure way to operate the electric system from an economic perspective. Furthermore, if the local consumer base operates on real time pricing tariffs with transparent price visibility there should be as close to true supply and demand relationship as possible. However, there are a number of regulatory, political, and legacy reasons that this is not a universal model.

On the other hand, the Swedish team believes that the utilization of a "Fixed Price with right of return," a new pricing product that they've developed, will provide proper price signals to consumers without unduly burdening them with full market risk. This product was developed as part of their Market Design Project. A summary of the product is located in the Swedish Business Model highlight section below.

2. Capacity Based Markets

For the purpose of this section, capacity based markets will include any market in which a DR asset can sell its future ability to provide DR. Based on this definition, three DR delivery models emerge:

a. Market based capacity

In this category, DR products actively compete in open markets alongside other supply resources. This makes the price paid for the DR capacity a true market based price.

An example of a product in use today that falls in this category would be Norway's Reserve Option Market. The Reserve Option Market is a balancing market used by the TSO to ensure reliable supply. The market rules for the Reserve Option Market allow any resource (generation or DR) to compete on an equal basis. The TSO then, by way of the product structure, acquires the right to call on the resource as needed.

Another example would be New York ISO's Emergency Demand Response Program. The rules for this product enable the DR resource to participate in the structured Installed Capacity market auctions along with other supply side resources.

b. Retail pricing discounts

In this category, the Energy Retailer and/or Local Distribution Company (LDC) offer the end use consumer a lower consumption rate or monetary rebate in exchange for the right to request load reduction when needed.

This concept is widely used with residential load control projects. The consumer gives the Energy Retailer or LDC the ability to limit its usage of things like water heaters, saunas, pool pumps, and HVAC in exchange for a lower than normal energy cost.

This strategy is also used by many traditional utility load curtailment tariffs. These tariffs are often targeted at commercial and industrial consumers. The tariff provides the consumer with a lower than normal KWh and/or KW cost in exchange for the right to require a load reduction when it is needed.

c. Bilateral negotiations

In this category, market actors negotiate for the right request consumer load reductions as needed. The transaction tends to take place between the TSO and a DR Service Provider, where the DR Service Provider is acting as the agent for a group of consumers. These transactions occur outside normal market operations.

An example here would be Italy's two interruptible products. These products were created to provide 3000 MW of emergency capacity in response to recent blackouts. These products do not transact in Italy's wholesale power market.

Another example would be ISO New England's Winter Supplemental Program 2005/2006. By way of this program, ISO-NE solicited DR bids to deal with a specific potential capacity shortfall. The capacity was acquired via a request for proposal (aka tender) process, but it did take place outside normal market operations.

D. Summary

Demand response business models are directly related to the local market environment and the perspective of a given market actor.

The local market operational structure will provide guidance on the way that DR can be utilized. For example, if the wholesale market structure is based on energy only markets, then things like capacity and/or option payments may not be easily acquired. An Energy Only market does not precluded DR activity, as evidenced by a DR aggregator in Australia that is doing so on a bilateral basis with energy suppliers, but it does make the potential revenue stream less certain. The reason is that the actual DR resource may only be needed a few times per year, or worse – a few times every few years. Given that the revenue potential may be less predictable in such a market, it may be difficult for DR aggregator to build a stand alone business focused only on DR aggregation. On the other hand, market actors like Energy Retailers, Local Distribution Companies, and Generation companies could develop fairly sound business cases based on hedging their existing risk levels even if the DR resource is only needed every few years – of course, this would depend on the costs for managing the product versus other hedging options. In addition, it is also likely that an Energy Service Company (ESCO) could build a sound business case in this market. The DR services would likely be related to existing ESCO service and simply be a logical service addition.

If the local market structure allowed for capacity and/or option structures, then the revenue stream becomes more predictable and sustainable. This would make it easier for independent DR aggregators to emerge. In fact, this sort of market structure exists in markets in the United States like ISO New England, New York ISO, and PJM. As a result, the US has seen the development and rapid growth of a number of businesses that were originally formed based DR aggregation alone. For example, ConsumerPowerline, a DR aggregator based in New York City, was created just a few short years ago from the one bedroom apartment of its Chairman. The firm recently ranked number 60 on Inc. Magazines 500 fastest growing firms. The posted a growth rate of 1100%. The firm now offers other services in addition to DR aggregation due to customer demand, but DR aggregation remains a key revenue source.

Another factor that impacts the structure of a DR business model is the perspective of the market actor. It is difficult, and perhaps impossible, to create a generic DR business model for all market actors because they have unique goals and objectives. For example, a TSO will not have the same cost structure (e.g. likely does not have retail sales people) that a DR Aggregator would. Therefore, the motivations and business purpose of each market actor must be taken into consideration when the business plan is drafted. The market structure and business operation of each market actor will dramatically impact the profitability of its business case.

However, it does seem that motivations for offering DR services from each market actor class around the world are fairly consistent. The method in which a given actor provides the service may be unique, but general benefits it receives for doing so are similar. For example, in many market around the world there is an entity that clears wholesale energy trades. Sometimes the role if performed by the TSO and sometimes there is an independent power exchange. Regardless of which firm performs the role, they are a key element to DR market liquidity. As such, the DR business case for these firms tends to be focused on creating market rules that enable DR resource participation in the wholesale market. Their motivations for doing so are usually based on the need to create greater market efficiency while helping to stabilize

security of supply. Clearly, a DR aggregator would not have the same motivation and given its need for a retail sales force, its cost structure would certainly be different.

It seems that most markets around the world have independently developed a two tiered delivery approach. There seems to be a demarcation between the wholesale market (e.g. TSO/power exchange to Energy Retailer/Generator/ DR Aggregator) and the retail market (Energy Retailer/Distribution Company/DR aggregator to Participating Consumer). This separation is quite reasonable. At the wholesale level, DR likely needs to operate on a similar basis to supply side resources in order for it to be included in the market. That's not to say that the DR must physically operate like a specific generator, it simply has to have the right market rules to allow its integration into the market. This is consistent with how the wholesale market operates today given that the wholesale market accommodates technical operational differences among its portfolio of supply resources (i.e. wind works differently than hydro).

Conversely, at the retail level not all consumers are able to provide the same type DR. By insulating the consumer from the wholesale market, a DR Service Provider can work with each customer to tailor a contract and service level consistent with the consumer's needs and abilities. Those contracts will likely be based on the DR Service Provider's wholesale obligations, but by aggregating large numbers of consumers they will be able to mitigate potential conflicts.

E. Sample Business Models

The United States and Sweden have provided the follow descriptions of DR business models used or contemplated in their countries.

1. DR BUSIESS MODELS: United States of America

Source: Dan Delurey, Executive Director USDRCC

The United States is a large country with multiple regional electric markets. These markets contain almost every permutation of market structures in use around the world. The markets range from liberalized to regulated; formal system operators to regional councils with bilateral operation; hydro dominated to fossil fuels; and, energy only to energy plus capacity markets. As such, the US provides a great place to see multiple DR business model structures.

A. Delivery of DR via Economic/Emergency/Reliability Products

Few if any business models in the U.S. are purely market based. Most of the current delivery of DR resources in the U.S. is done via demand response products at either the wholesale or retail level. Much of it is delivered by way of economic or reliability products. The business models utilized include:

1. Utility delivery under traditional regulation

A large amount of demand response is delivered in the U.S. via what are often referred to as legacy load control products. These normally involve a utility installing communications and control devices on specific end-use equipment of customers.

These customers enroll in a program whereby they are rewarded with payments when their load is curtailed. The business model is simply one whereby the utility internalizes the costs of the control devices and payments and it becomes part of the rate base or else is expensed. Vendors may provide the equipment but not be involved in the operational aspects of the program. These products have traditionally involved control of the load only by the utility but advances in technology have resulted in new products where the customer also has control over the load and often has override ability.

2. Utility delivery under structure where electricity commodity is deregulated

Where a utility is in a state where electricity has been deregulated and customers may elect to purchase electricity from a competitive retail marketer the incentives for the utility, essentially now a wires company, are fewer than under the traditional vertically integrated structure. Some utilities are acting as a "middle man" and helping their customers participate in DR products of the regional grid/market operator, and taking a part of the incentive from the operator to cover their costs of doing so. Other utilities are beginning to seriously assess DR as something that they receive performance incentives for if they reach agreed upon targets, a system that has been used by some utilities in the past for their efficiency/conservation products.

3. Third Party delivery to utility in block

In both regulated states/areas and those still with traditional vertical integration and regulation, a new model for DR delivery has emerged. It involves a third party being a "negawatt" provider to the utility whereby it aggregates a number of customer loads and acting as agent for those loads delivers them to the utility as part of a demand response program, with the negawatt provider receiving revenue from the program incentives paid and/or a share of the savings that the customer receives to their bottom line. This business model is similar to the "performance contracting" model used in the energy efficiency industry in past decades and in fact some DR companies are taking a "holistic" approach where both DR and energy efficiency measures are incorporated in a comprehensive energy management offering to customers.

4. Third Party delivery to Regional Transmission/Market entity.

In much of the U.S. a regional entity exists that manages the wholesale market. Known as Regional Transmission Operators (RTOs) or Independent System Operators (ISO), these entities when created were not seen as ones which would operate demand response products. In fact, however, these entities have moved to fill the vacuum for demand response resources resulting from the lack of state and utility products to put both economic and price-responsive products in place. These products normally involve the utility or a 3rd party DR provider acting as intermediary between the customer and the RTO/ISO and thus models 2 and 3 above are followed.

5. Delivery by retail electricity marketer

In addition to companies whose prime business model is delivery of DR resources (see above), retail marketers in deregulated states also represent another entity working to deliver DR. These marketers may act as the intermediary between the

ISO/RTO and the customer as noted in Model 4 tonight. They may also combine their energy commodity offerings with demand response offerings.

6. Third Party customer representative

Some companies have developed around a business model solely focused on being the intermediary between a utility/RTO/ISO and the customer. They offer no other services and follow the same basic model of taking a share of the DR incentives/payments and/or customer bill savings.

B. Delivery of DR via Price Responsiveness

Price responsive DR normally refers in the U.S. to dynamic, time-based pricing. These pricing models can vary from traditional time-of-use rates to critical peak pricing to real-time pricing, and there a number of variations of each with new hybrid models being discussed. The business models include:

1. ISO/RTO Products

Regional wholesale market entities have price responsive products as well as those of the economic/emergency variety. As in the case of the latter products (described above) intermediaries often exist to complete business model and facilitate customer participation. With retail prices in the U.S. still being subject to state (vs. federal) regulation, wholesale DR pricing is seen as having a significant but limited ability to contribute demand response resources.

2. Utility Pricing

Many if not most utilities have had time-based pricing options available to customers for over two decades, but customer participation is in most cases extremely low, with the prevailing assessment being that the products are not attractive to customers as designed and not aggressively promoted. The business model for utilities is straightforward as a rate design and tariff exercise. This model may see greater deployment in the near future given that newly enacted federal energy policy directs states to undertake a fresh investigation of such pricing. Working against

3 Market-based pricing

When a number of states in the U.S. moved to deregulate and restructure their electricity industry, it was anticipated that this would lead to more market-based demand response. This has not occurred as retail marketers have had challenges competitively delivering basic commodity offerings. The result has been little development of dynamic pricing offerings from marketers (although some have been more active in providing such to their larger customers. Some states have begun to deploy time-based “default” pricing for customers who choose to not enter the market, with an objective of forcing these customers to move to the market. Again, however, the primary, if not only, targets of such default pricing have been large customers.

2. DR BUSINESS MODELS: SWEDEN

Source: Peter Fritz, Market Design Project – Demand Response Resources in Sweden, Elforsk Report 06:41

The Swedish team has been analyzing the impacts of DR in Sweden via an effort known as the Market Design Project. One of their main objectives was to identify potential business models that will elicit DR in their energy only market. They have identified the following five possible business models (excerpted from their report. The full report is located on the Task XIII project portal):

a. Fixed price with the right to return

A model where the customers have the correct market price transferred to them in real time will yield the greatest potential gain. From a national economic point of view, a spot price model that continuously gives the correct price signals to the customers has a significant advantage. However, such a model exists, but is not very successful with household customers. The customers' choice of agreement shows that very few customers have chosen the closest current equivalent, i.e. spot price calculated on average monthly values (and settlement according to profiling). The greater majority of customers appear to choose an agreement with price fixing (1-year contract or longer). It warrants discussion whether it is reasonable to insure oneself against just this price risk, while the household's other purchases don't have such options. The fact remains, however, that so far the customers have, to a large extent, chosen fixed price agreements.

Our suggestion is a model where the customer subscribes to a certain amount of electricity divided per hour. The degree of complexity in such an agreement can of course be varied, but we maintain that it is probably sufficient to vary the subscribed volume between seasons, alternatively months.

Such an agreement means that the customer meets the spot price in the margin and therefore has the incentive to respond to the price signals, without it resulting in the whole price risk being shifted onto the customers. We view this as an attractive offer to the customers.

The advantage with a spot price contract, compared to the other models outlined in the report, is that gains can be achieved even in situations when no price peaks arise. The drawback is of course the continuous price information to the customer, making his decision more difficult. Instead of only reacting when a specific signal arrives, the customer needs to consider if any action is to be taken in each situation. For this reason there might be cause for some sort of signal enhancement in extreme situations, for example in the form of a text message warning of situations with unusually high price.

b. Dynamic time of use tariff (Critical Peak Pricing)

Dynamic time of use tariff has the advantage of giving a clear signal to customer when it is particularly important that they act. This can be expected to increase the response on these occasions and the model is easy for the customers to understand. The drawback with the dynamic time of use tariff is it doesn't give any price signals about the current availability and demand situation in instances that aren't defined as critical.

In Sweden, the model has been applied in trials within the frame of the Market Design project (see section 2.1). The results from the trials have been very promising. Approximately 20% of the customers (household customers) that were offered this tariff model have accepted it. These customers have halved their demand on average during the high price hours.

c. Direct remote control of small customers
In Sweden, there are around 300 000 family homes with direct electrical heating. Installing control equipment for electrical heating systems was investigated quite thoroughly during the late 1980's in Sydkraft's project Toppkap. The conclusion then was that this probably is cheaper than investing in peak generation. In Market Design, a system for soft control, still in operation, was tested. The system is functioning as expected. The customers have in general been willing to partake with only a small compensation. However, the costs for technology in the existing systems have been high.

The new metering (AMR and AMM) systems that now are been installed can probably manage this to a lower cost than was possible with the technology tested in the late 80's. Some of the grid companies plan to invest in systems prepared for some kind of two way communication, but we still don't know how many of the customers that will have readers with this kind of functionality.

d. Aggregation of emergency power plant
In connection with Svenska Kraftnät's extended purchase of reserve capacity, a new type of player has been established, the ***aggregator***. The aggregator sells a solution in which existing emergency power plants are modified so they can be used as a capacity reserve. The total capacity from existing emergency power plants is estimated at 1000 MW (in total around 1600 MW). How much of it is practically available is less certain and depends on the costs. Even without financing from SvK there is a role for these players. The business model is based on the aggregator signing a deal straight with the customer who purchases his electricity at spot price. Allowances for fixed costs can possibly be attained from the grid owner on the condition that these too can take advantage of the customer's flexibility.

It is probable some advantages of scale in doing this and in particular those players who already have an operations centre that are the ones with the best conditions to take upon this aggregator function. We have no set idea as to which player on the market would be the most suitable for this role; instead we see that electricity dealers, grid companies and other independent operators could potentially develop this business concept, as we've already seen examples of in Svenska Kraftnät's reserve capacity purchase. Our indicative cost estimate shows that profitability can be attained after only a few high price hours, given our assumption about the price during these hours.

e. Demand sell back
This method has been tried with large customers in the Industribud project and for middle-sized customers in Market design. The customer provides steady information to his electricity supplier where he states what compensation is required to reduce the consumption. If the spot price is higher than these bids, the electricity supplier can buy demand reduction instead of power.

III. DR PRODUCTS

Task XIII created an Online DR Product Database to give users a way to review DR product structures in other markets. The database contains information provided by the respective Country Experts.

For the purpose of organization, the products provided were organized into three primary categories:

1. Reliability / Emergency Structures
2. Economic / Demand Bidding Structures
3. Real Time / Pricing Structures

The Reliability / Emergency Section is focused on products where someone has a "call option" on a resource. In these products, the resource tends to receive some sort of reservation payment for the ability to respond to a load reduction request from another party. Consumers that receive these payments typically have a "best efforts to run" obligation.

The Economic/Demand Bidding Section is focused on products where a consumer (or its agent) bids in a price at which they are willing to sell their reduction. These products are generally voluntary from the perspective that the consumer either decides to bids or not bid. The consumer is also generally paid in some relation to the hourly energy market for their reductions.

The Real Time Pricing / TOU Section is focused on commodity pricing that has incentives for consumers to use power based on market conditions. These consumers typically are not paid for their actions, but they do avoid paying the market rate for the power they do not consume during that period.

NUMBER OF PRODUCTS PER COUNTRY PER CATEGORY

Country	Reliability / Emergency Section	Economic/Demand Bidding Section	Real Time Pricing / TOU Section
Australia	14	5	1
Canada	1		
Denmark	2		1
Finland	1	1	2
Italy	2		
Norway	3		
Spain	3	1	1
Sweden	7	1	1
USA	18	37	9

Assessing which DR product(s) in the database is best is kind of like asking a parent with multiple children which one they like the best. The answer is likely to be that they are all great in their own way. In other words, each product was designed to serve a specific purpose within a specific set of related market structure realities. In addition, the concept of "best" in this context can be relative. Does best mean which

pays the consumer the most (the least)? Does best mean which product has the greatest MW enrollment? The point here is that there are many ways to evaluate this issue and few of them would be universally valuable to all Task XIII project participants.

For example, it would be difficult to say that NY ISO's Emergency Demand Response Program (EDRP) would be an ideal candidate for all markets to mimic because this product is designed to fit within NYISO's capacity markets. Many regions around the world do not have a capacity market, therefore EDRP would not be very helpful. On the other hand, this product has many great attributes that have made it very successful in terms of enrolled MW volume and utilization when needed.

On the other hand, it is possible to highlight a few DR products and discuss why some of their features are innovative.

Norway: Reserve Option Market

Statnett, the Norwegian TSO, has a responsibility for ensuring the security of supply for their national market. While the primary wholesale market is run by Nordel, a common Nordic power exchange, Statnett has the ability to manage its own operating reserves requirements. In recent years, Statnett has developed business rules that allow DR to participate in a balancing market called the Reserve Option Market. By way of this market, Statnett pays the Participating Consumer, or their DR Service Provider agent, for the call option right to the DR resource.

There are a few things that make this an interesting product:

- First, the market was designed to allow DR and supply resources to compete on an equal basis. Incorporating the supply side and the demand side for products that are used at the system peak will make the grid more economically efficient.
- Second, given that DR is primarily a peaking resource; the Reserve Option Market is an effective way to engage the Participating Consumer on a continual basis thereby helping to ensure that they will be available when they are needed. DR is usually only needed by the power grid a few times per year if it is needed at all. Therefore, the industry must find ways to make sure the Participating Consumer remains interested and educated. As demonstrated by the DR Valuation analysis in Chapter 5, DR may only be used a few times in five years, but those events can cover the costs for sitting idle for many more years. On the other hand, if the consumer and/or the DR Service Provider's interest wanes then they may not be available when they are needed.
- Third, this market structure provides a degree of forward revenue certainty. This predictability allows DR Service Providers to develop business cases for aggregating consumer DR. It also makes it possible for both Participating Consumers and DR Service Providers to investigate DR technology investments.

Sweden: Fixed Price with the right to return

Swedish energy industry leaders spent a couple years discussing ways to help manage their long term security of supply via a project they called Market

Design. While their market currently has ample reserves, they do anticipate a need for additional peaking supply within the next few years. However, the current market price may not provide ample incentive for the development of new plants. As a result, they fear the "feast or famine" problem with generation supply. The group felt that incorporating DR into the portfolio will help to mitigate some of this risk. Therefore, the question they faced was how to do it.

As discussed in the Business Model section above, the Swedish team considered multiple options. While all of the options are valuable, "Fixed Price with the right to return" stands out from the rest because it is a consumer friendly way to match load consumption with market price signals. This product encourages DR participation by way of a commodity pricing mechanism as opposed to offering financial payments to the consumer for the load reduction. The product is designed for residential consumers, the majority of whom are fairly risk adverse. The product allows the consumer to fix a portion of their consumption at set rate and float the remaining amount with the spot market. This structure helps to influence the consumer's usage of variable loads while giving them the comfort level of the fixed price component.

Pricing products such as Real Time Pricing (RTP), Critical Peak Pricing (CPP), and Time of Use (TOU) have been used for many years to influence consumer consumption patterns. While many of these products have been successful, a key criticism of them is that they are designed from the grid's perspective, not the consumer's perspective. Residential consumers that are offered RTP and Fixed Price tariffs generally default to the Fixed Price tariff because it gives them a feeling of security. The product proposed by the Swedish team attempts to look at the rate structure from the consumers perspective while matching it with the needs of the grid. This idea is innovative because it uses more of a carrot versus the stick approach. While the product usage is still in its infancy, the consumer response has been very favorable.

USA: ISO New England Real Time Demand Response

This was one of the first wholesale market based DR products initiated in the United States. There have been some tweaks to it since it was first created, but the basic structure is essentially the same. The product is designed to help the ISO manage regional reliability problems. Financial payments are made based on the greater of the real time market price or a fixed floor price of $0.50/kWh for a 30 minute response or $0.35/kWh for 2 hour response. New England is moving towards a locational Installed Capacity Market and the resources will qualify for that as well.

The thing that differentiates this product from others is its use of Internet based metering technology. ISO New England requires all end users in its Real Time Demand Response product to use an Internet Based Communication System (IBCS). An IBCS is capable of transmitting 5-minute usage data to the ISO's control room every 5-minutes for each meter point enrolled in the program. This system gives the control room operators

increased visibility and surety of DR performance. It also can give them the ability to call on targeted loads to deal with specific issues.

Many system operators around the world have expressed an interest in receiving DR meter reads in near real time. Historically this was accomplished by using RTU devices. An RTU unit has demonstrated high reliability and can provide virtually instant readings. However, the trade off is that they are very expensive and therefore prohibitive for most DR loads. On the other hand, IBCS metering and related software packages are substantially less expensive on a relative basis. This seems to have provided a reasonable compromise between the desire for performance information and the infrastructure expense to get it.

As noted above, there are several dozen more products in the online database available for review. The preceding products were highlighted because they have some unique attributes that should be contemplated during future DR product designs.

DR Database Data Fields

The product database has up to 50 attributes for each product. The Country Experts attempted to provide data for all fields, but some information was either not applicable to the particular product or it was not publicly available information.

The following is sample of the available data:

Attribute	**Description**
Country	Where the product is in operation
Product Type	One of the three categories listed above
Market	Liberalized or Non-Liberalized
Product Description	Brief description of what the product is designed to do.
Number of Participants	To provide an order of magnitude
Total Participating MW (also sub divided into load shedding on onsite generation if available)	To provide an order of magnitude
Eligible Participants	Type of consumers
Call Criteria	Situation that would trigger DR event
Response Period	Speed in which the DR must respond
Respondent Option	Mandatory or voluntary participation
Duration	Length of event participation
Compensation	Product incentive structure
Performance Measure	Method for calculating DR event compliance
Metering method	Metering strategy
Notification method	Event notification

The database has a search feature that allows the user to find a specific product or a group of similar products. This is accomplished by allowing the user to create a search query by selecting from key select attributes.

The search criteria attributes are as follows:

Participating Country
Product Type
Market Type
Total number of participants
Total number of MW
Response Period
Respondent Option

By using these data attributes the user will be able to quickly locate products that match the search criteria. Once that occurs, the list of matching products will be populated in new drop down box. The user can then select up to three products for side by side comparison purposes (NOTE: it is limited to 3 at a time for visual and printing purposes).

The following chart illustrates the type of information contained in the database:

Item	Selection 1	Selection 2
Countries	Denmark	USA
Product Type	Real Time Pricing Structures	Reliability / Reserve Structures
Product Sponsor	EU-Save Research Programme	NYISO
Market	Liberalized	Liberalized
Product Name	Denmark / EFFLOCOM Pilot (2002-05)	Emergency Demand Response Product (EDRP)
Product Description	Automatic load reduction of electric space heating in households. EU-Save research programme. The pilot is extended with one more year in Demark	Participants are paid the greater of Real Time Locational Based Marginal Price (LBMP) or $500/MWh of load reduction. Participants will be paid for at least 4 hours per event (at least 2 hours as specified above and the remaining non-EDRP hours at LBMP)
Web Site		
Date Updated	7/6/2005	4/28/2005
Product Year	2005	2004
Total Number of Participants	25	1,140
Participant Number (DG)		
Participant Number (Load Shedding)	25	
Participating DG MW		249
Participating Load Shed MW		343
Total Participating MW	0.125	593.700
Marketplace Peak Demand (MW)	2,600	30,983
DR Percent Of Peak Demand		1.90%
Number of Product curtailment events		Not activated in 04
Dollar Amount Paid to Participants		
Amount Paid Notes	During winter of 2003/2004, customers saved on average 80 Euros by DR bonus and 40 Euros by energy savings.	
Period	Two winters 2003-05 - during weekday peak periods morning and afternoon	May 1, 2001 - Oct 31, 2005
Eligible participant	Households with electric heating	LSE, Direct Customer, Aggregators, & Curtailment Product End Use Customer (Available to interruptible load & emergency

		backup generation - including generation in excess of host load.
Eligible load	Electric heating (space and water)	>100 kW per NYISO Zone, may aggregate within zones.
Call Criteria	Spot price exceeds a TSO specified level during morning or afternoon peak	Operating Reserves Deficiency or other emergency state (Activated after ICAP/SCR resources if deemed necessary by Operators)
Response Period Notes	Real-time automation system	2 hours, if possible
Response period	Minimum of 30 Minutes before event	Minimum of 2 Hour before event
Respondent Option	Voluntary	Voluntary
Respondent Option Notes	The participant can set a maximum duration of interruption, and can also override if the interruption is inconvenient.	Voluntary/No penalties
Duration	1-3 hours per interruption. Maximum 100 hours per winter	Four hour minimum call
Compensation	Depending on the spot price level the payment was 0.13, 0.26 or 0.39 Euro/kWh. Total number of DR hours was 100 hours.	Greater of Real Time Locational Based Marginal Price (LBMP) or $500/MWh of load reduction. Participants will be paid for at least 4 hours per event (at least 2 hours as specified above and the remaining non-EDRP hours at LBMP)
Baseline Criteria	Based on both consumption on a similar weekday (time-of-day + temperature) and/or the consumption just before the load was cut	5 highest of 10 prior days
Performance Measure	The goal of reduction of 5 kW on cold days was met. 24 of 25 customers would recommend the system and every customer did choose to continue before the second winter 2004/2005	Baseline difference
Payment Channel	TSO directly to customer	NYISO -> LSE/CSP -> end-use customer
Metering Method	Hourly metering of electric heating all the year	Hourly interval meter
Notification Method	Prices sent by GPRS	2 hour prior notice via the internet, email, phone, pager notification
Software Requirement	Web interface	Internet
Enabling Technology	Hourly metering. Comm. by GRPS & customer Web interface	
Product fees		None specified
Type of product	Pilot study	
Market place	Denmark - East	
Remarks	The houses in this pilot are in the high consumption fractile. If scaling to electric houses in general, the DR potential is expected to be up to 4 kW per house.	

DR PRODUCT SPOTLIGHT: NORWAY'S RESERVE OPTION MARKET
Source: Ove Grande, Sintef

The Norwegian System Operator, Statnett, must dispatch sufficient operating reserves to balance the system in real time. If generation cannot meet demand Statnett will be penalized financially if it must disconnect load to save the system.

Statnett needs a minimum of 2000 MW of fast operating reserve for the Norwegian Balancing Market. Due to the limited generation margin, there is a risk that all Norwegian generating capacity might be sold in the day-ahead Elspot market on winter week days both to cover Norwegian demand and to be exported. To comply with the Regulations, Statnett developed an options market to secure sufficient fast operating reserves in high demand periods. This Reserves Option Market was launched in 2000.

The Reserves Option Market secures sufficient regulating power for the Balancing Market. Statnett is purchasing the right (option) to dispatch regulating resources in generation as well as in demand. Both resources compete on equal terms. In the early phase, the contracts lasted 1-12 months.

The Reserves Option Market has resulted in a substantial volume of demand to compete with generation. A number of consumers have found it financially interesting to prepare for demand disconnection on short notice. Mainly big industrials have participated, though there is a potential for smaller demand to participate. Statnett is initiating pilot projects to arrange packages of smaller consumers and encouraging more consumers to bid demand disconnection in the day-ahead Elspot Market, especially in periods with high spot prices.

In addition to the weekly contracts in the Reserves Option Market, Statnett has entered into a few bilateral agreements of 5-10 years' duration with generators. The agreements have contributed to rehabilitation of old units and increased the size of units to be installed. At the same time Statnett has secured some of the operating reserves at an interesting cost. Additional agreements will be considered. More information is available at www.statnett.no.

IV. DR MARKET BARRIERS

A market barrier can be considered as something that unfairly restricts access to a market. This could occur when regulations do not keep up with emerging technologies or industry standards; when the incentives for participating in a market are disproportionate to the incentives received by others for complementary services; or, when a dominate market player or group of players unfairly prevents new competition. For example, in the early 20th century steel industry, the titans used their market power to prevent competitors from forming[2].

The demand response industry is relatively new, especially when compared to other supply side options. This means that the DR industry must find ways to operate along side other supply side options. Unfortunately, it also means that normal industry operation did not incorporate DR into its operating framework. The market rules and corresponding technology requirements were designed around existing supply side solutions. Unfortunately, many of these rules initially made it difficult for large scale use of DR (e.g. SCADA metering). But as the DR industry continues to grow and, more importantly, demonstrate its ability to provide safe reliable capacity when it is needed, the electric market finds ways to remove some of the initial challenges.

DR can provide the benefits that the industry argues are possible, but there seems to be number of reasons that it has not yet reached its full potential. Some things are cultural (e.g. "it's new and we don't know what to do"), some things are regulatory (e.g. consumers are generally insulated from real time market conditions) and some things are institutional (e.g. DR was not designed into many liberalized market transformation processes).

Demand response resources have had many successes over the last few years. DR has demonstrated an ability to provide reliable peaking/balancing power in several Scandinavian nations, helped the US power grid recover from its Northeast blackout in 2003, and Australian researchers have shown, by simulation, that active DR solutions can make its markets more efficient. However, despite these successes, the energy industry has not taken full advantage of the benefits that DR can provide.

Part of the reason that DR has not received full market adoption is a result of it only recently being considered as a physical resource on par with other capacity resources. Historically, vertically integrated utilities would use load curtailment contracts/tariffs to provide emergency back-up capacity for super critical days. In this regard, the energy provider was basically counting DR as part of its peaking capacity resources. However, even though the power grid derived benefit from having these resources in place, the energy markets had little use for them because they did not conform to traditional trading practices (e.g. 100 MW blocks).

[2] The European Union's Office of Fair Trading recently published guidelines for "Assessment of Market Power: Understanding competition law". The document provides interesting insights into market power issues.

Therefore, the resource was constantly undervalued in the resource portfolio. For example, there have been situations where load management groups attempted to "sell" its capacity to an intra-company trading desk for near market value, but the trading desks were only will to offer pennies on the dollar - if anything at all - because the capacity did not have "tradability". One could argue that the resource helped the trading group reduce the amount of capacity it would otherwise have to acquire; however, that argument is difficult to win when it's an in-house accounting transfer issue.

On the other hand, it should be noted that the inability of product to find a market is not necessarily caused by a market barrier. It might be a function of the products inability to solve a market problem (e.g. the technology is premature or obsolete) or its cost structure cannot compete with other competitive solutions. For example, the telephone has long since surpassed the telegraph as a primary means of long distance communication.

A. Market Barrier Categories:

Task XIII is charged with compiling a collection of DR market barriers from its participants. This requires thinking about the type of data collected and how to categorize the data so it is helpful and readily usable.

Therefore, the information is categorized in the following three ways:

1. Cultural Issues: This would include things such as lack of consumer/aggregator education, the right supporting technologies are not in place, consumer behavior is difficult to change, and incumbents do not want competition.

2. Regulatory Issues: This would include things such as consumer commodity tariffs that are do not reflect market cost, incentives for participation are not in line with benefits, and regulatory uncertainty makes it difficult to make needed investments.

3. Institutional Issues: This would include things such as DR not designed into the original market design, DR has a small voice relative to other incumbent voices, and some operating practices require large infrastructure investments, lack of agreement on how DR can/should be used, and lack of agreement on what it takes for DR to be recognized as a useful resource.

B. Common Challenges

All Task XIII participants believe that DR is useful and important to their respective markets, but most do not believe that the ultimate solution for doing so has been fully identified. Part of the reason for this is that DR is a relatively new concept. Load management and load curtailment products have a fairly long history, but incorporating them into recently liberalized market structures has only been occurring for less than 10

years. As a result, the energy industry and its consumers are still searching for more efficient ways to make it happen.

A couple issues that have influenced the search are:

- Tragedy of the Commons: The biggest problem most people point to is that there is a clear societal benefit to DR, but in some circumstances it is difficult for individual stakeholders to have enough direct benefit to participate.

- Market Liberalization Process: In most cases, the market liberalization process did not consider DR from the onset of market design. This created a supply side mind set when the business processes and market infrastructure were developed. This means that DR not only needs to identify how it can help the market, it must also work with the local institutions to figure out new business processes that are conducive to DR operations.

The project team discussed a number of issues impacting the development of DR in their local markets. Some of these issues were unique to a market, but there are a few issues that were identified by almost all participants.

	Common Challenges	**Suggested Actions**
1	Consumer Awareness - Don't know what DR is - Unaware of their demand flexibility - Unaware how they benefit from DR	- Develop case studies showing how others have participated and benefited. - Initiate awareness campaign (radio, billboard, news reports, seminars)
2	Price Signals - Consumers accustomed to fixed cost per kWh - Wholesale to retail disconnect - Limited use of locational pricing	- Utilize DR products and tariff pricing that link consumer behavior with energy cost - Initiate trials to test local market adoption
3	Meter Data - Most meters in use today do not record hourly intervals - Limited use of data exchange standards - Limited incentives to make new investments	- Load profiling methods can be used in some circumstances - Allow meter owners ability to recover costs for upgrades - If AMR is used, make sure the functionality works with desired DR products prior to installation
4	Market Operations - DR may be precluded from participating in wholesale market - DR must conform with supply side market rules (e.g. large trading blocks)	- Use trials to demonstrate DR ability to serve the wholesale market

DISCUSSION: Common Challenges

Consumer Awareness:

The lack of consumer awareness is one of the main challenges facing all participants. In the Market Actor discussion (section II.B. above) consumers were segmented into three broad categories: Large Commercial & Industrial, Small Commercial & Industrial, and Residential. A key distinction between these classes is their relative sophistication when it comes to buying and using energy.

A consumer's sophistication is normally proportionate to the amount they pay for energy in both absolute dollars and cost relative to their other expenses. This is also true when their degree of awareness is considered. Many large users are very aware of their DR opportunities as well as their own demand flexibilities. But, most small C&I and residential consumers may not have the same knowledge.

Fortunately, this is probably the easiest one to resolve. Assuming that the DR products are established and available, consumer awareness campaigns can quickly educate the masses. The key here is that the campaign should explain how the consumer can benefit themselves and the region by participating; suggest ways for them to identify demand flexibility at their facility; and, explain how they enroll. An easy way to do this is by creating case studies that illustrate the experience of others.

Price Signals:

In capitalist societies, the relationship between supply and demand set the price for almost everything people use. But in the electric industry, most consumers have historically been offered fixed prices for every kWh they consume. This insulates them from the hourly price movements that occur. The consumer does not mind this situation because it gives them a degree of certainty. Unfortunately, it may not be the most efficient way to operate the power grid.

It is known that consumer behavior, and therefore their energy needs, can be modified with the right incentives. Under the theory of supply and demand, when the price goes up a percentage of consumers will reduce their usage. There will ultimately be an equilibrium price at which the available supply matches with consumer demand. Assuming that this is a widely agreed upon belief, the issue then gets focused on identifying the best way to provide price transparency to the consumer.

A number of strategies have been used around the world. Things such as real time pricing, critical peak pricing, time of use pricing, and Sweden's new "Fixed with the right to return" are all designed to match consumer behavior with market costs. In addition, options contracts such as Norway's Reserve Option Market and the New York ISO's Emergency Demand Response product are market based products that will trigger consumer load reduction when the grid needs it.

Meter Data:

Interval metering is not an absolute requirement for a successful DR product. Consumer consumption can be translated into hourly in usage based on a number of accepted load profiling techniques. But, actual interval meter reads would provide a more accurate representation of the consumer's consumption.

Many markets around the world have begun investigating or installing broad based interval metering networks. For example, the United States 2005 Energy Policy Act required the Federal Energy Regulator Commission to investigate the degree in which such networks are used in the country. And, the Netherlands is in the process of completing its business case analysis for installing interval meters at every consumer. In many instances, these systems are installed to reduce meter reading costs and improve the operational efficiency of the local power supplier or distribution network. Of course, the same system can also be used to better match consumer usage with actual market costs.

However, there are a few things that should be considered before the networks are deployed. First, given that the new metering networks will likely cost billions of dollars, it would be prudent to make sure that it can support the appropriate functional DR requirements prior to making the investment. Second, the entity that owns and operates the metering network should be allowed to recover the cost of their investment. The interval meter is an enabling DR technology. All consumers will benefit from greater price transparency, so it is reasonable to encourage its use. Finally, meter data exchange standards need to be simplified and utilized. Depending on the market structure, there can be multiple market actors that need access to the usage information. ISO-New England uses a simple data standard to exchange DR meter data. Similar methods could be used elsewhere to keep infrastructure costs to a minimum.

Market Operations:

It's been noted many times that DR is a relatively new product. Because of this, the industry was not sure how to use it. In some markets, DR has been precluded from participating in the wholesale market. For example, Spain does not allow DR to participate in its operational reserve or balancing markets, though they are preparing a pilot project to test it. These concerns are understandable. It is not reasonable to expect instant adoption. The industry has a responsibility to ensure grid reliability. That will not happen if structural changes are constantly being made.

Several markets in the United States had similar concerns when DR was first introduced. However, these concerns began to disappear as the market actors used the product. They figured out ways to design products that worked within the wholesale market structure while also providing reasonable surety that the asset will be there when it is needed. For example, some products are designed to be completely voluntary. In this case, grid operator can estimate how many MW might show up, but they usually do not count that in the reserves. Alternatively, there are products designed specifically for operational reserves. These products are usually included in the reserve requirement. Norway's

Reserve Option Market provides another data point illustrating DR's ability to support market needs.

The message here is that market trials will help the players get comfortable with DR. This is a critical step. Additional products can be developed immediately thereafter.

C. DR Market Barrier Survey

Task XIII Country Experts were asked to provide their insights on current DR market barriers facing their markets. Their insights are represented in the tables below. The information has been grouped into the three market barrier categories discussed above, namely Cultural, Regulatory, and Institutional Issues.

CULTURAL ISSUES

Country	Issue	Potential Actions
Australia	Lack of consumer awareness; resistance to reducing summer AC usage	• Continue engaging consumers in demand management trails • Encourage use of technology to simplify multi-site aggregation
Denmark	Consumers desire fixed cost per KWh	Create multi-part pricing with a fixed component plus a reward for DR participation when needed
Finland	Consumers are not aware of their potential demand flexibility	Promote case studies illustrating how consumers can use existing technologies to manage loads.
Netherlands	Lack of interval metering and ICT networks	
Norway	Lack of interval metering and need for better data quality and data exchange standardization. Need for: o Increased customer awareness of DR opportunities o Innovative products from retailers including AMR and RLC options.	Focus on demand side price elasticity in the "physical" markets (Elspot, Regulation Market)
Spain	Consumers accustomed to fixed pricing; lack understanding of DR benefits; in some cases, current tariffs are lower than actual market price	Initiate trials and promote consumer successes via case studies.
Sweden	Lack of hourly metering; new law promotes monthly (currently some are only read annually), but does not provide incentives for LDC to install interval metering	Some LDCs have installed interval meters on their own in order to improve internal supply management efficiency. These could be used DR purposes as well.
USA	Pace of technology advancement make firms afraid of buying the wrong thing	Assess the DR needs for the market first (e.g. DR Valuation Methodology) then choose technologies that provide that functionality
USA	DR is a relatively new discipline; more research needed	Continue (and increase) funding DR research activities

REGULATORY ISSUES

Country	Issue	Potential Actions
Australia	Lack of appropriate price signals; no real incentive for commodity supplier or LDC to provide the signals.	Regulatory intervention to: • include locational price signals • remove price caps • increase interval meter usage
Denmark	LDC owns is responsible for metering. They cannot charge retailers for meter data services, so there is little incentive to install new interval meters.	Allow the LDC to recover costs of interval meters and data management services.
Norway	Power system vulnerability focused. The importance of more end user flexibility emphasized.	• More easy to change supplier • Separate invoice from Network Company and Supplier • All customers can require hourly metering at a maximum cost (~ 300 €). • The Network Company, who is responsible for metering, is obliged to treat all Suppliers equally.
Finland	AMR use is growing, but technical features are not standardized. This makes data exchange difficult and expensive. It may also mean that the system may not always support desired DR functional needs.	• Assess DR needs first, and then design AMR functionality to meet those needs • Regulator to champion functional specs and data exchange standardization. • Regulator can also help by allowing DSO to cover AMR system costs.
Finland	Lack of price transparency at the consumer level; small consumers are settled based on load profiles	• Continue growth in AMR – use for settlement purposes • Educate consumers on benefits & risks of RTP
Spain	DR is currently not able to bid into the operation markets (reserves, balancing, etc).	Initiate trail to demonstrate that it is possible.
USA	Retail competition created a vacuum in terms of DR actors and responsibility	System operators have assumed the role of promoting DR activity by default.
USA	Some utilities are unable to recover the costs of providing DR service	Given that DR provides benefits to all of society, the LDC should be able to recover its costs

INSTITUTIONAL ISSUES

Country	Issue	Potential Actions
Australia	Difficult for DR to participate in wholesale market.	Encourage DR aggregators to bundle DR loads as a service to distributors and retailers.
Denmark	Wholesale market rules favor supply side bids	TSO is working with market participants to develop user DR friendly business rules
Finland	Wholesale and ancillary service markets require 10MW bids	Allow DR service providers to aggregates loads
Sweden	TSO currently responsible for capacity reserve, but this ends in 2008 and they wish to terminate this responsibility	Sweden is working on a new Market Design that will promote greater use of RTP.
Netherlands	Market liberalization split the utility into different operating units. Their efforts are focused on improving their current operations.	Case studies from other markets can demonstrate how the various actors might develop DR solutions.
Norway	Economic incentives for individual market actors may not be sufficient to generate interest even though there is significant socio economic benefit	Currently evaluating market design adjustments that may provide greater incentive
USA	Electricity regulation has been based on the “obligation to serve”, this created a supply side oriented marketplace	EPACT 2005 motivated the entire electric industry (FERC, DOE, State PUCs, LDCs) to consider ways to incorporate DR and interval metering

NOTES