Clean First:

Aligning Power Sector Regulation With Environmental and Climate Goals

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The global scientific, and now political, consensus is that anthropogenic emissions of greenhouse gases must be decreased over the next four decades (roughly the lifetime of a power plant) by at least 80 percent below current levels. The lack of a comprehensive United Nations climate change agreement does nothing to alter this consensus. The challenge for the power sector and power sector regulators is profound, especially in light of the prospect of electrifying the transportation sector. New renewable resources will have to be added at an unprecedented rate, carbon emitting sources will either have to be phased out or coupled with investment in carbon capture and sequestration, and energy efficiency will have to occupy a central role in the new resource mix.

What policies will get us to where we need to be? High-level fixes like carbon taxes and cap-and-trade are not silver bullet solutions. Experience shows putting a price on carbon will effect some positive change but, if relied on exclusively, the carbon price needed to meet our goals will be so high that the policy will not be feasible. Fortunately, there are many foundational policy options which, when combined with carbon pricing approaches, deliver effective and low-cost carbon savings.

The power sector is complex. Policies that seem sensible from one perspective may have large, adverse, and unintended effects on the environment or on renewable and other low-carbon resources. This brief looks at the sector anew and recommends that nations adopt a simple prescription for avoiding these unintended effects while putting the sector on a steady trajectory to meeting our long-term climate and environmental goals—that is, that make meeting climate and environmental goals part of the mandate for power sector regulators. It is a long overdue step toward integrating energy and environmental regulation. We call this fundamental policy reform "Clean First."[1]

A. The Clean First Policy Suite

Clean First is not a single policy, but rather a comprehensive suite of policies that flows from the overarching principle of aligning national power sector policies and practices with national climate and environmental policies. The specific policies will vary from country to country as regulators consider country-specific environmental goals and power sector conditions. This brief introduces the general concept and then identifies possible policies for the US.

The need for Clean First is based on the indisputable fact that energy and the environment are inextricably linked. Power sector decisions, even those that do not appear to have environmental consequences, can indeed have profound consequences, in both the short and long term. Explicit consideration of the environment and the environmental attributes of power sources is not only reasonable, but necessary to meet the enormous challenge

[1] This idea was first presented in Olsen, David, *Renewables—First Generation/Transmission Projects,* at the Windpower 2007 Conference, Los Angeles, 6 June 2007, pp. 17-19. http://www.daveolsen.net/Windpower%207-4-07.pdf

of climate change.[2] Put another way, clean resources—those that minimize air and water pollution (and use water efficiently), toxic waste streams, and land-use impacts—should get every reasonable preference, whether it be in siting new transmission, access to the transmission system, cost allocation, or in grid operations generally, over resources that have greater environmental impact.

Some counties have already moved well down this path. It is, for instance, a principle of European Union policy. Article 11 of the Lisbon Treaty states, "Environmental protection requirements must be integrated into the definition and implementation of the Union's policies and activities, in particular with a view to the promotion of sustainable development." The UK has been engaged for more than two years in a comprehensive Transmission Access Review aimed at reforming industry practices to help meet the county's ambitious climate goals.[3] And China has adopted a number of policies—among them, phasing out older and less efficient coal-fired power plants, energy efficiency standards for major industries, "efficiency power plants," and emissions-based generation dispatch—that will both increase economic efficiency and reduce greenhouse gas and other emissions.[4]

B. The Argument

Power sector regulators and stakeholders have always strived to meet multiple and sometimes competing objectives and priorities. Objectives such as "safe, adequate, reliable service at reasonable prices" and principles such as prohibitions on "undue discrimination" are common in most parts of the developed world. No power sector policy would be adopted if it jeopardized safety, adequacy, or reliability. Policies to reduce prices have always been balanced by considerations of reliability and safety. Similarly, Clean First will lead to crafting new policies aimed at meeting environmental goals and these policies will have to be balanced with price and reliability concerns.[5] Clean First essentially is a needed step toward fully integrating our energy and environmental policy and regulation.

The words used to define the basics of power sector regulation in most countries have not changed for decades, but their definitions have evolved to meet changing conditions, technologies, and goals.[6] For example, the notion of prohibiting "undue discrimination" originally referred to price and service discrimination, but today it also represents a concept at the core of liberalized market reform.[7] Likewise, the principle of "just and reasonable" prices, which for decades signified an adherence to cost-of-service regulation, now indicates a strong commitment in some jurisdictions to market-based prices. The language of power sector regulation must evolve further to incorporate 21st century goals.

Existing power sector policies have served nations well. Modern electric systems have proven resilient, reliable, and efficient. But application of these policies (and others that flow from them, such as some approaches to transmission

[2] Even without the enormous and immediate challenge of climate change to spur us, there is good reason to integrate the economic and environmental oversight of the sector: cost is reduced and efficiency increased.

[3] See http://www.ofgem.gov.uk/Networks/Trans/ElecTransPolicy/tar/Pages/Traccrw.aspx

[4] Weston, F., et al., "China's Climate Change Initiatives," Regulatory Assistance Project, November 2009, for the National Association of Regulatory Utility Commissioners. www.raponline.org/docs/RAP_Weston_ChinaClimateInitiatives_NARUC_2009_11_01.pdf

[5] Resource adequacy is "the ability of the electric system to supply the aggregate electrical demand and energy requirements of the customers at all times, taking into account scheduled and reasonably expected unscheduled outages of system elements." Gross, G. and P. Ruiz, "Resource Adequacy in Competitive Electricity Markets," *Power Engineering Society General Meeting, IEEE 2004,* University of Illinois, Vol. 1, pp. 1014-1015.

[6] The United Kingdom has been revising Ofgem's (Office of the Gas and Electricity Markets) basic objectives recently. Since 2004 Ofgem has the duty to consider the achievement of sustainable development. In 2008, the Energy Act promoted this duty, placing it on an equal footing with our duties to meet reasonable demand and financing authorized activities.

[7] In a number of countries and regions, electric sectors have been liberalized: increased entry by competitive generation, organized competitive wholesale markets for generation have been created and, in some cases, competitive retail markets as well. A common feature of these reforms has been non-discriminatory access of participants to the market. That is, discrimination based solely on the question of asset ownership is prohibited. But non-discriminatory access, which is a prerequisite to competitive markets and a protection against the exercise of market power, is not unconditional: markets have all sorts of performance requirements (operational, legal, and financial) participants must meet. Clean First is simply another such requirement—environmental in nature.

pricing) have tended to work to the advantage of large, traditional thermal resources—such as baseload plants whose high load factors render firm transmission capacity low-cost (on an average throughput cost basis). This is not surprising in a system of planning and operations that does not expressly consider environmental effects. Moving forward, a system cannot be deemed reliable or its resources adequate in the long term if it isn't also environmentally sustainable. Sustainability is a core aspect of reliability and the national interest. Clean First corrects that deficiency in the current system.

C. The Means

Clean First will lead to different policies in different countries. For example, a Clean First overlay to transmission access may be an appropriate approach where there are competitive generation markets but not where there remain fully regulated monopolies, for which integrated least-cost planning is better suited. What follows here, in no particular order, is a menu of options that may apply in the US and in particular to issues under the jurisdiction of the Federal Energy Regulatory Commission (FERC). While this paper focuses on current institutions and policies specific to the US, many of the options presented below for aligning power sector regulation with environment and climate goals will have international applicability.[8]

Identifying all of the FERC policies that might flow from a Clean First principle would be impractical, but we will briefly describe some of the especially promising possibilities. We hope that these policy options will stimulate thought and that others will add to the list. They will, of course, have to be put to a rigorous analysis of costs and benefits to determine which stand to be most effective.

We have divided the policies into five categories—(1) Transmission Pricing and Access, (2) Capacity Markets, (3) Dispatch, (4) Ancillary Services, and (5) Transmission Planning and Siting—and describe them in the following subsections.

1. Transmission Pricing and Access

We identify five sets of policies relating to transmission pricing and access to the grid.

A. NEW INTERCONNECTIONS

In the US, connecting new generation to the grid involves payment of fees and potentially long waits for system planners to conduct reliability and integration studies. This has been widely seen as a major barrier to the addition of renewable resources. FERC, transmission owners, regional transmission operators (RTOs), and independent system operators (ISOs) have been trying to address the issue within the context of their existing authority and practices. These options have mostly focused on raising deposits significantly to weed out "dead" projects (i.e., projects unlikely to achieve commercial operation); moving projects that have met financial, technical, and site control requirements ahead of other projects; and studying multiple proposed generating projects in "cluster" studies.

In the UK, aggressive national renewable energy goals have collided with intolerable delays connecting new renewable energy generation, causing the government to initiate major reform efforts. As discussed below, some of the options considered in the UK and in use in the EU may make sense in the US.

Under current US interconnection practices, no consideration is given to the environmental attributes of the generation seeking to be connected. Furthermore, clean energy projects may be blocked from proceeding because of larger conventional generating projects that are "ahead" in the queue. In addition, the recent steep increases in interconnection costs are especially burdensome to renewable resources.

How might a Clean First policy change the way the issue is addressed? We offer two options.

i. Managed Queue

The most direct approach would accord eligible resources preferential and streamlined treatment for access to the bulk power grid. They would, in effect, go to the "head of the line" for reliability studies, typically managed by a queue.[9] This would have several effects:

- Reduced delay and related cost to connect to the grid for qualifying clean resources, providing a valuable measure of certainty during project development.

[8] A separate paper will examine China's Clean First options.

[9] To be eligible to go to the head of the line, clean projects may have to meet reasonable criteria designed to ensure that the project is real and has a high probability of being completed, such as having site control, making up-front deposits to pay for study costs, meeting specified deadlines, and perhaps agreeing to limited ability to suspend studies on their project.

- Priority for clean resources (subject to security and reliability requirements), if available transmission capacity is limited. Because each interconnection study takes into account all of the projects ahead of it in the queue, going to the head of the line will mean clean projects will be given priority if available transmission capacity is limited.

- New proposals for high-carbon sources would face increased risk.[10, 11]

ii. Connect and Manage

This option is based on a policy being considered by the UK and which has been implemented by UK National Grid on an interim basis and is in effect in several other countries.[12] This approach acknowledges that, with the addition of major new sources of wind generation, the transmission system will not be, nor will it need to be, upgraded to accept the theoretical sum of all installed capacity. It acknowledges that the transmission system will be shared, so connections should be simplified, and reliability should be dealt with on a system-wide level. "Connect and manage" assumes that the system—through market rules, dispatch, etc.—will be managed to meet reliability and renewable energy goals.

The opposite, in fact, occurs in parts of the US, where there are no organized markets.[13] There is a distinction made between new generation requesting "network" or firm point-to-point services and new generation requesting "energy only" services. With the latter, the extent of prior transmission system analysis and required system upgrading is limited, but, in the event of a problem, the energy-only generation will be the first to be curtailed. Clearly, in the case where the new generation is wind, this policy bars zero-operating cost, zero-polluting generation in favor of existing generation with higher cost and emissions. The US method of "energy only" is similar to "connect and manage," except here the system is "managed" based on a first-in-time priority system instead of economic or environmental factors.

B. INTERCONNECTION COST ALLOCATION

Connecting new generation to the grid also requires new generation to bear the cost of related transmission. Related transmission costs can be divided into two categories: (1) direct connection costs, which include all the facilities needed to connect the generation to the grid, and (2) network costs, which refer to facilities needed to reinforce the existing network to reliably integrate the new generation with the grid.[14]

The direct connection costs are generally borne by the new generation without much controversy. Treatment

[10] A related concept to giving priority in the interconnection queue to clean energy resources is to provide a separate queue for clean energy resources and give priority in planning for the clean energy queue. An "open season" could be held to identify potential clean energy projects, perhaps with a significant deposit to ensure that the potential clean energy projects are "real" projects, and then the potential clean energy projects could be studied as a cluster. The California Independent System Operator is in the midst of conducting its first transmission plan solely for renewable energy resources, as transmission is widely recognized as a key limitation towards meeting the California RPS. From that will be identified transmission projects designed and intended for clean energy resources, primarily for the California RPS. Clear cost allocation for transmission will need to be determined up front.

[11] Under FERC's Order No. 2003, interconnection requests must be processed on a first-come, first-served basis. In order to manage queue backlogs, CAISO and SPP sought approval of and implemented cluster studies of interconnection requests. To date, clusters have been implemented by grouping interconnection requests pending as of a certain point in time, but this will not promote renewables unless the particular cluster is renewables-heavy by geographical accident (such as wind in Tehachapi, California). We understand, however, that some transmission providers are considering additional grouping criteria, such as by geographic area. In theory, this could facilitate interconnection of renewable resources that share similar geographic characteristics. This idea is only in the formative stage and, ultimately, will need FERC approval.

[12] Germany and Alberta also have "connect and manage" systems in place. Clean renewable energy is given priority when re-dispatch is needed to manage congestion.

[13] "Organized power markets" refers to power markets with an Independent System Operator (ISO) or Regional Transmission Organization (RTO) that operates a regional energy market, capacity market, or both. This paper does not distinguish between RTOs and ISOs–which provide equivalent reliability services–and we refer to these entities generically as regional "system operators" in the following sections.

[14] In the EU, direct transmission costs are referred to as "shallow" transmission costs. Indirect costs are referred to as "deep" transmission costs.

of the network costs is more variable and contentious. Considerations of fairness and the allocation of costs to the beneficiaries of the network upgrades have tended to dominate the discussions. Under current practices, there is no consideration given to the environmental attributes of the generation.

How might a Clean First policy change the status quo? The most direct way would be for the environmental costs and benefits of the generation in question to be factored into decision-making on how to share the costs of system upgrades. Until now, sharing the cost of network upgrades has been justified by the broad reliability benefits flowing from the transmission investment, the inequity of charging the full cost of lump investment to the next project, and the desire to assign costs to beneficiaries of system upgrades, even if those determinations are complex and subject to considerable change over time. With Clean First, the degree of public benefit will also turn on the environmental attributes of the associated generation. If the associated generation is clean, it will deliver environmental benefits that justify a broad-based sharing of some or all of the transmission interconnection costs.[15]

Experience in the EU varies. In Denmark and Germany, renewable resources pay only the costs of the direct interconnection. The cost of network upgrades is socialized. Policies in the UK are under review. In Texas, which is not subject to FERC jurisdiction, the Electric Reliability Council of Texas allocates network upgrade and new transmission costs to all customers.

C. AVAILABILITY OF FIRM TRANSMISSION ACCESS

Under current rules, in non-RTO areas such as the western US, clean energy projects have difficulty obtaining financing if firm transmission is not available or is too expensive (on a per-megawatt-hour basis, given lower-than-average capacity factors). But although transmission in non-RTO areas may be fully allocated under contract, most transmission is not fully used. Some observers have suggested a sort of hybrid transmission service that would be in-between firm and non-firm known as "conditional firm" service. Such service would be considered firm except under either of two circumstances: (1) during certain peak demand hours when the transmission may be needed to ensure reliability or (2) pursuant to reliability rules, when the transmission operator curtails generation (up to a specified number of hours per year). FERC approved conditional firm service in Order 890 but limited the maximum contract term to two years, limiting its effectiveness for clean energy generators that need long-term contracts to be financially viable.

Transmission planners have generally aimed to design the system to provide firm service to all connected generation. This philosophy may need to change as the nation begins adding large amounts of intermittent renewable resources and other low-carbon resources. To meet the climate challenge, renewables will be replacing carbon-emitting energy and fossil-fueled capacity will increasingly play a supporting or enabling role.[16] Given the intermittent nature of wind, solar, and run-of-river hydro resources, total installed capacity of all generating resources will greatly exceed expected customer load plus a reasonable level of reserves. Building a transmission system that is capable of integrating all of the installed capacity, assuming it is all online, is not an economically sound option. The transmission system needs to be shared, and current notions of firm transmission service may need to be rethought. Some reasonable system of priorities must be established.[17] Keeping the lights on will always have the

[15] Under FERC Order No. 2003, the costs of network upgrades to interconnect a new generation facility are borne by the generator. However, the generator receives a credit for transmission service in the amount of the upgrades funded. If there were a change in policy such that network upgrades were funded directly by the transmission provider, the credit for the generator would be eliminated but the generator would be subject to full transmission charges. So the timing of the payments would change, but the dollar amounts paid would not. The CAISO is experimenting with a variation on this approach through its location-constrained resource interconnection rules. CAISO provides up-front funding of network upgrades through its transmission access charge, and generators become responsible for their pro rata shares of costs as they come on line and use the upgrades. In addition to minimizing the burden of lump sum, up-front payments, the CAISO mechanism has the effect of spreading network upgrade costs over multiple generators. Similarly, the clustering of interconnection studies mentioned above has the effect of mitigating the lumpiness of interconnection costs for individual generators.

[16] See, for example, *Eastern Wind Integration and Transmission Study,* National Renewable Energy Laboratory, January 2010. http://www.nrel.gov/wind/systemsintegration/ewits.html

[17] See "The Extent to Which Economic Regulation Enables the Transition to a Sustainable Electricity System," PE Baker, Prof: C Mitchell and Dr B Woodman, April 2009. http://www.ukerc.ac.uk/support/Energy%20Supply

highest priority. But beyond reliability, what considerations matter? With Clean First, the environment will be a significant factor.

How might a Clean First policy change the way we approach the issue? The most direct option may be to do away with the distinction between firm and non-firm service and move to a system that gives priority to delivering clean resources to loads. This is essentially the "manage" portion of "connect and manage." An option with similar effect would be to allocate firm transmission rights to clean resources first, pushing other resources further back in the queue, even those that have historically had firm transmission rights. This is the approach taken in Denmark and Germany, where renewable resources have guaranteed firm transmission rights.

D. Transmission Rate Design

The level and structure of transmission price can significantly influence the choice of generation technology. Current practices vary across the US. In organized markets, transmission costs are generally recovered from retail load, not individual generators. With this approach, transmission rate design is not a significant issue. The practical effect of this approach is comparable to recovering transmission costs from generation on an energy basis.

Outside of organized markets, generators most often pay for point-to-point service. Prices for this service are typically charged on the basis of maximum connected capacity. This tends to favor high-load factor plants, which generally run on fossil fuel, and hurt most renewables.

How might Clean First change transmission rate designs? Where transmission costs are recovered from generation, the most direct approach would shift transmission rate design from a capacity charge to an energy basis. This is far better for renewable resources that have low capacity factors.[18] The result is to transform transmission rate design in areas without organized markets to be similar to the effective rate designs in organized markets.

E. Building New Transmission

i. Incentives for New Transmission

In the US, the Energy Policy Act of 2005 authorized FERC to establish incentive-based (including performance-based) rate treatment for transmission investments that ensure reliability or reduce the cost of delivered power by reducing congestion. FERC established a rebuttable presumption that a project is eligible for an incentive return on equity if: (1) the project emerges from a fair and open regional planning process that evaluates projects for reliability, congestion, or both and it is acceptable to FERC or (2) it has received construction approval from an appropriate state commission or siting authority. FERC also requires the applicant to demonstrate that the requested incentives address the risks or challenges faced by the applicant.[19]

How would a Clean First policy affect transmission incentive policies? The most direct approach would distinguish between transmission investment incentives based on the environmental costs and benefits of particular transmission projects. This is an approach nearing implementation in the UK.[20]

ii. Energy Efficiency and Non-Transmission Alternatives

Apart from the issue of transmission upgrades relating to the addition of specific generation, there is the more general question of the means by which the costs of new investment in transmission are recovered. This can affect how resource decisions are made, particularly when the choices are between transmission and non-transmission alternatives, especially energy efficiency. For example, in New England, the costs of grid investments that are necessary to maintain the overall reliability of the system are covered by all load-serving entities. Thus, the lion's share of the costs of a line required to meet growing demand in, say, southern Connecticut is borne by customers in the other New England states. Except

[18] It should be accompanied by revenue regulation (referred to in the US as "decoupling"), wherein the revenues that the transmission company collects do not vary if and as sales volumes vary. So long as the revenue level is set appropriately, there would be sufficient cash flows to support investment in new transmission capacity.

[19] See FERC Order Nos. 679 and 679-A.

[20] See http://www.ofgem.gov.uk/Networks/Trans/ElecTransPolicy/tar/Documents1/100118_TOincentives_final_proposals_FINAL.pdf

in a few narrow circumstances, cost-effective demand-side alternatives to transmission, such as end-use energy efficiency, do not receive like treatment, but instead are paid for in large part by customers in the service territories where these resources are installed.[21] Under these circumstances, utility managers and policymakers, seeking to minimize the costs that their customers and constituents face, are naturally inclined to the transmission option even if the alternative is lower cost and cleaner.

How might this change under a Clean First policy? The most direct approach is to adopt a policy to ensure that cost-effective energy efficiency, demand-response and clean distributed resource alternatives are acquired before the investment is made in transmission.[22] For example, preconditions to "socializing" the costs of a proposed reliability-enhancing transmission investment might include:

(1) Full consideration of energy efficiency and clean, non-transmission alternatives. For example, this may mean:
   a. An integrated resource plan that has incorporated all cost-effective demand-side resources (including clean distributed generation) into the assessment of need for the proposed transmission investment.
   b. Full recognition, in organized markets, of the contribution of demand-side resources (including clean distributed generation)) to system reliability.

(2) The cost recovery of energy efficiency and other non-transmission alternatives is comparable to the cost recovery of the transmission option.

2. Capacity Markets

Experience with liberalized markets in the US has shown that, for a variety of reasons, the markets were not producing sufficient generating capacity. The response was to use traditional planning studies to determine the appropriate level of capacity – to meet projected demand plus reserves – and to augment the day-ahead and real-time energy markets with a forward-looking capacity market aimed at securing that identified amount of capacity several years in advance of need. The first such market was developed for the New England states and is referred to as a forward capacity market. A similar capacity market also is now in place for PJM, an RTO that serves the Mid-Atlantic and several Midwest states.[23]

In one respect, forward capacity markets represent a great advance for climate and environmental goals because they are the first to have been expressly designed to incorporate demand-side resources. However, their success in delaying the retirement of high-emitting power plants and encouraging new fossil-fuel generation makes a strong case that additional policies are needed to align forward capacity markets with carbon goals.

If, without the help of traditional planning tools, energy markets fail to deliver the right amount of capacity, they certainly will not deliver the right mix of resources.[24] Indeed, from an environmental perspective, shortcomings of forward capacity markets include:

- The encouragement of high-emitting resources (including repowering) at the expense of low-carbon alternatives, because there is no consideration of environmental costs or resource sustainability; and

[21] Such resources are truly alternatives to transmission if they are sufficient to maintain overall system reliability. The energy- and peak demand-reducing qualities of end-use energy efficiency establish its reliability benefits, but other resources, such as distributed generation and combined heat and power, may need to be combined with real-time demand response capabilities.

[22] Cowart, Richard, et al., *Efficient Reliability: The Critical Role of Demand-Side Resources in Power Systems and Markets*, prepared by the Regulatory Assistance Project for the National Association of Regulatory Utility Commissioners, June 2001, at 52. By lowest cost, we mean lowest total societal cost, which takes into account the environmental and other external costs of a resource. Where an RTO or ISO is not in existence, the obligation would fall to the affected transmission-owning entity. http://www.raponline.org/Pubs/General/EffReli.pdf

[23] See Meg Gottstein and Lisa Schwartz, *The Role of Forward Capacity Markets in Increasing Demand-Side and Other Low-Carbon Resources: Experience and Prospects,* Regulatory Assistance Project, May 2010. http://www.raponline.org/docs/RAP_Gottstein_Schwartz_RoleofFCM_ExperienceandProspects2_2010_05_04.pdf

[24] The right mix is more than just a policy preference. Even without consideration of environmental costs, the right mix means a specific mix of power plants and demand side resources designed to minimize the total capital and operating cost of the system.

[25] Gottstein and Schwartz.

- The encouragement of the continued (or increased) operation of existing, high-emitting power plants, because forward capacity markets as currently designed pay the market clearing price to all resources (including existing plants) that can commit on a forward basis to producing electricity at projected peak demand periods.

How would a Clean First policy change forward capacity market rules? The most direct way is for the rules to distinguish between resources based on their environmental attributes. The auction design already distinguishes between existing and new capacity in setting the clearing prices: under current bidding rules, existing capacity must be a price taker and rules for emergency (back-up) distributed generation in the New England forward capacity market have been designed to reinforce regional air quality policies and goals.[25] Auction design can be altered to implement rules that distinguish among resources based on their environmental attributes.[26]

Clean First may lead to several changes to the framework of forward capacity markets to support low-carbon resources, such as:

- Linking winning demand-side bids to new provisions in energy markets to ensure that energy benefits are reasonably compensated;
- Providing premium payments to non-carbon or low-carbon capacity;
- Selecting auction winners based on level of carbon emissions as well as bid price;
- Paying capacity payments to only those new resources with low- or zero carbon emissions;
- Phasing out capacity payments to existing, high-emitting resources; and
- Allowing a longer price commitment or establishing fixed capacity floor prices for low-carbon alternatives.

These changes would have several effects. They would support clean and low-carbon resources, while also providing a specific policy platform to drive the retirement of older, high-emitting resources.[27]

3. Dispatch

In most parts of the world, the real-time operation of generation is dictated by some form of merit order dispatch—that is, dispatch based on the variable costs of the units. The lowest variable-cost (or bid-price) facilities are operated first and, as demand increases, additional units are called upon in ascending order of their costs. As demand decreases, the units are taken off line in reverse order. Merit order dispatch ensures the most economical operation of existing capacity. However, the failure of such an approach to recognize the un-priced environmental and other external costs of generation means that economic efficiency, in its truest sense, is not achieved.

Regulation of greenhouse gas emissions—for instance, a carbon tax or cap-and-trade regime—would, depending on its design, internalize some or all of the otherwise un-priced costs of electricity production and would, in some measure at least, improve the relative economics of clean resources. The problem with this approach is it would require a very high carbon price to change dispatch in any significant way. A much lower-cost option is to impose the dispatch order by rule.

A Clean First dispatch rule, under which the order of operation is determined by the emissions characteristics of the resources (non-emitting first, dirtiest last), would prove effective and, very likely, less costly overall.[28]

[26] One justification for such a redesign of capacity markets lies in the "just and reasonable" standard of rate-making: can the prices that emerge from a market that fails to adequately account for and manage the huge environmental risks of fossil-fired generation appropriately be found to be just and reasonable? This reasoning, if accepted, would represent perhaps the most significant integration of environmental and energy policies to date. One might go further and argue that ignoring the climate change implications of particular resource acquisition decisions is to act imprudently.

[27] On 21 January 2010, FERC initiated a Notice of Inquiry to consider, among other things, whether existing capacity market rules need to be reformed in order to better integrate variable generation, including wind and other renewables, into system operations. The Commission is seeking comment on whether capacity rating rules, day-ahead bidding rules, and compensation options are unduly discriminatory as applied to variable generation.

4. Ancillary Services and Grid Operations

As mentioned in Footnote 27, FERC recently issued a Notice of Inquiry (NOI) for the purpose of "taking a fresh look at existing policies and practices in light of the changing characteristics of the nation's generation portfolio with the aim of removing unnecessary barriers to transmission service and wholesale markets for VERs." VERs are variable energy resources such as solar and wind. Ancillary services (reserves, regulation, balancing, etc.,) are a focus of the NOI.

For example, the NOI points out that current scheduling practices were designed at a time when virtually all generation on the system could be scheduled with relative precision. With more wind and other intermittent resources in the power grid, FERC notes that system operators appear to be relying more on expensive reserves, such as regulation reserves, to balance the variation in energy output.

FERC is examining these important issues, but it is doing so within the confines of its existing authority. How would the outcome of the NOI change with Clean First? Currently, the costs of supporting the grid through ancillary services are charged to all customers, so the direct effect on clean resources is not particularly severe. Nevertheless, there are additional options that could be considered with a Clean First foundation. The most attractive options are:

- Development of a new class of ancillary services and grid practices aimed specifically at supporting the integration of renewable resources.

- The curtailment of non-clean generation first, when curtailments are required to maintain reliability or reduce transmission congestion. If clean energy generation is curtailed, ensure that the generator is compensated for the lost energy value and the value of any applicable tax incentives or lost renewable energy credit sales.

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[28] In China, this policy is very near its first practical implementation. China's current method of power plant dispatch is highly inefficient: more coal is burned more pollution emitted, and greater cost incurred than is otherwise necessary. To address this problem, in 2007, the National Development and Reform Commission of China adopted an impressive policy innovation: an environmental dispatch rule. The implementation details of the rule are now being finalized, but its general effect is clear. The current inefficient dispatch practice, which is based on equity principals (rather than marginal cost), will be converted to one based on thermal efficiency and pollutant (specifically, sulfur dioxide) emissions. The result will be that the cleaner, more efficient plants will be operated before dirtier, less efficient ones, thereby significantly improving dispatch as environmental dispatch reduces coal-use and emissions—and will do so even more effectively than a simple bid-based approach would. In turn, the dispatch rule will drive new investment to low-carbon and thermally efficient generation that receives this preferential treatment. The rule is straightforward. Power plants will be scheduled to meet hourly demand according to this sequence:

(1) Non-dispatchable renewable energy generating units, such as wind, solar, ocean, and run-of-river (i.e., non-storage) hydropower facilities;

(2) Dispatchable renewable energy facilities, such as hydropower with storage, biomass, and geothermal units;

(3) Nuclear facilities;

(4) Combined-heat-and-power units that meet specified thermal efficiency criteria and whose operations are determined by thermal energy demand;

(5) Natural gas, coal-bed gas, and coal-gasification generating units;

(6) Coal-fired generating units, including combined-heat-and-power generating units not meeting minimum thermal efficiency requirements; within this category, power plants with the same heat rates (thermal efficiency) will be ranked according to their emissions of air pollutants (per unit of electrical output); and,

(7) Oil-fired generating units.

See National Development and Reform Commission, "Administrative Measures on Energy-Saving Dispatch (for Trial Implementation)," 节能发电调度办法实施细则 (实行), Circular No. 53, 2007, available at http://www.chinapower.com.cn/article/1120/art1120479.asp.

We note also that, in the UK in 1970s and '80s, the system operator (then the Central Electricity Generating Board, or CEGB) would switch to heat rate-based dispatch during fuel shortages, which occurred regularly in those years. Because this related operations to thermal, rather than economic, efficiency, it had the effect of creating a "minimum carbon" merit order for dispatch.

5. Transmission System Planning and Siting

Transmission planning is rapidly evolving from a process driven incrementally by individual generation projects and individual utilities to one that recognizes the enormous challenge of adding large amounts of renewable energy to the system. Put another way, this describes the transition from the world of cost-based regulation to one driven by policy. At the state level, for example, the California ISO has been especially active in this respect. It has concluded, "The primary driver of new transmission infrastructure over the coming decade will be the need to integrate new renewable generation resources into the transmission grid and support the delivery of energy from these resources to end-use customers to achieve the state's target of 33 percent renewable energy on an annual basis by 2020." Its most recent proposal specifically makes access to renewable resources a new criterion for determining need for transmission upgrades.

The CAISO is in the midst of conducting its first transmission plan for renewable energy resources. It has also established a policy for location-constrained resources, whereby transmission costs will be assigned to load until sufficient quantities of location-constrained resources come on-line, after which the costs will be shared. California, the Western Interconnection as a whole, and Texas are identifying renewable energy zones – areas with the potential for large-scale renewable energy development and low environmental impacts – and working to overcome barriers to build transmission from those zones to load centers. The new interconnection-wide planning collaboratives, with attention to public interest-oriented scenario development, represent an important system-wide view that will likely demonstrate the value of clean resources.

How would transmission system planning be different with Clean First? A Clean First transmission system planning approach would apply these state and regional ideas in all regulatory venues. Model scenarios of clean resource portfolios that address emerging reliability deficiencies would stand ahead of or at least next to transmission-oriented solutions. These system plans would communicate to policymakers, regulators and resource investors a full range of options to fully inform future decisions.

Transmission siting is primarily under the control of states. The question of whether the current system of siting transmission lines is best suited to build facilities needed to connect and integrate massive amounts of wind and other intermittent resources is already heavily debated. Regardless of which authority is in charge, Clean First can influence transmission siting if transmission planning fully informs decision-makers about the value of clean resources to the grid and decision-makers are allowed to consider this information. If future statutes confer special status on transmission facilities dedicated to integrating clean resources, then this special siting process would inevitably incorporate Clean First.

[29] For example, both the China's Ministry of Environmental Protection (MEP) and the US EPA are considering long-term reductions in demand for electricity, derived from investments in high-efficiency end-uses and building envelopes, can help meet regional air quality standards. Earlier this year, for example, MEP promulgated a new regional air quality management rule. Principle Five, *Circular of the State Council, Ministry of Environmental Protection and other departments on joint prevention and control of air pollution to promote the work of improving regional air quality,* 14 May 2010. In India, the Prime Minister has proposed the formation of a committee to make recommendations on how the five-year planning process can be reformed to put the country on a low-carbon growth path. Government of India, Planning Commission Press Release, 1 July 2010, available at: http://moef.nic.in/downloads/public-information/Carbon%20Economy%20-%20Press%20Release.pdf.

D. Conclusion

This brief is intended to stimulate a creative discussion about how to achieve the large-scale clean resource investments that are necessary to meet climate change mitigation, energy security and economic goals in the power and transportation sectors. We've only begun to name the many ways that economic and environmental policy might combine to secure reductions in climate-changing emissions.[29] The task ahead is enormous, but enormously vital. Integrating energy and environment considerations in ways faithful to regulatory foundations yet adapted to new objectives points the way and is necessary to success. Modest adjustments to the status quo will fall short.

A change in perspective about the relative value of resources is inevitable – the role of many elements of the existing generation fleet will change to support and enable clean generation, and new clean generation will need to carry more weight to support grid reliability and commerce. The Clean First perspective sketched here offers a way to apply these changed global priorities in the individual regulatory decisions that occur every day and add up to the future.

The Regulatory Assistance Project (RAP) is a global, non-profit team of experts that focuses on the long-term economic and environmental sustainability of the power and natural gas sectors, providing technical and policy assistance to government officials on a broad range of energy and environmental issues. RAP has deep expertise in regulatory and market policies that promote economic efficiency, protect the environment, ensure system reliability, and fairly allocate system benefits among all consumers. We have worked extensively in the US since 1992 and in China since 1999, and have assisted governments in nearly every US state and many nations throughout the world. RAP is now expanding operations with new programs and offices in Europe, and plans to offer similar services in India in 2011. RAP functions as the hub of a network that includes many international experts, and is primarily funded by foundations and federal grants.

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