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February 2021

Comments on Draft Electricity Law Revisions

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Officials in China recently proposed changes to the Electricity Law.[1] This memo offers suggestions regarding the proposed revised law, drawing on international experience.[2] Overall, the new language regarding "clean energy," "renewable energy" and "demand-side resources" (such as in the new version of Article 6) will be very helpful in supporting the Chinese government's goals for power sector reform, air quality improvements and a zero-carbon economy — including the government's new 2060 and "before 2030" goals for carbon emissions. Indeed, it would be useful to reference those 2030/2060 goals in the revised Electricity Law and state that all provisions in the revised law should work to support those goals.

Clarify Roles and Design Principles for Electricity Markets

Overview and Key Issues

The reported draft revisions to the Electricity Law include new language regarding electricity markets, which complements the draft Energy Law provision that requires "giving play to the decisive role of the market in the allocation of resources, building an effective competitive market structure and market mechanism, forming a mechanism in the competitive field where the market determines energy prices, and establishing an effective energy regulatory system" (Article 14).[3] In particular, we applaud the reported Electricity Law draft requirement that "the establishment of electricity markets should … promote the rational allocation of resources and energy conservation and emission

[1] Draft Electricity Law revisions were reported in the media in September (in Chinese): https://www.sohu.com/a/421672356_120877465

[2] For selected examples of relevant legislation in various other countries, see the appendix.

[3] In April 2020, the National Energy Administration released a first draft of an Energy Law (in Chinese): http://www.nea.gov.cn/2020-04/10/c_138963212.htm

reduction" (Article 39). There has been much debate among observers in China about the purpose and objectives of the new electricity markets, and this clarification should help to focus that discussion on efficiency and emissions goals.

Conceptually, electricity markets can be thought of as tools that can help achieve social objectives and policy goals, including improving the efficiency with which the power system is operated (electricity dispatch) and sending rational signals for investment. In turn, this helps lower costs and emissions. But markets can help do these things only if they are designed and regulated well. Electricity markets around the world are embedded in — and wouldn't function without — detailed rules and regulatory structure. While the fine details of these rules and regulations are typically set out by policymakers, regulatory agencies and the system and market operators, the law can also play an important role in setting the framework.[4]

We would like to emphasize three market-related issues that we think are very important, given our understanding of the status of China's current market reform efforts. First, we raise the issue of scarcity pricing. At the heart of any well-designed spot market is the principle of prices that fluctuate throughout each day and according to location, in response to changing demand and supply conditions on the grid. In places and times of system stress, scarce supply or high demand (or a combination of all three), it is natural to expect that prices can rise quite significantly — although these periods of high prices may be quite rare. Scarcity pricing is the way a spot market supports economic outcomes; that is, it motivates economic dispatch. It also motivates investments, including appropriate amounts of flexible resources (such as energy storage, demand response and gas-fired generation capacity), and motivates retirement of unneeded inflexible resources.[5] High prices at times of scarcity are not something to be feared. International experience demonstrates that markets respond to scarcity in ways that, in the longer run, minimize total system costs.

Second, in countries with successful electricity markets, market regulators, system operators and market operation organizations collect detailed data continually in order to estimate and monitor the operational costs of generation units. The market and system operators use these reference levels to judge whether the markets are competitive and operating efficiently — and whether any generators are able to manipulate the market power. The estimates are also used to regulate generator bids and market prices, where markets fail to produce efficient outcomes.[6]

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[4] For background and additional recommendations on electricity markets, see: Regulatory Assistance Project & Natural Resources Defense Council. (2017). *Electricity wholesale markets: US experience and recommendations for China.* Available in English and Chinese. Regulatory Assistance Project. https://www.raponline.org/knowledge-center/electricity-wholesale-markets-us-experience-and-recommendations-for-china/. For international experience with electricity market regulation, see Dupuy, M. (2020). *Regulating electricity markets: Experience from the United States and perspectives for China.* Available in English and Chinese. Regulatory Assistance Project. https://www.raponline.org/knowledge-center/regulating-electricity-markets-experience-from-the-united-states-and-perspectives-for-china/

[5] Dupuy, M., Kahrl, F., & Wang, X. (2020). *'Energy revolution' and power sector reform: Insights on challenges in the China Southern Grid region from a comparative international perspective.* Regulatory Assistance Project. https://www.raponline.org/knowledge-center/energy-revolution-power-sector-reform-insights-challenges-china-southern-grid-region-from-comparative-international-perspective/

[6] Dupuy, 2020.

Finally, countries around the world are working to expand the geographic scope of market footprints to take advantage of the way in which the variability of wind and solar generation tends to even out over larger geographic areas.[7]

Recommendations from an International Perspective

We suggest the following options for consideration in the Electricity Law to clarify the role and design of electricity markets:

- "Electricity markets should be designed for efficient scarcity pricing so that prices reflect real-time conditions at various locations on the grid."
- "Electricity markets should also be designed to provide efficient price signals to help guide rational investment in needed clean resources and retire unneeded fossil-fueled resources."
- "Electricity markets should be designed to provide a level playing field for clean energy resources, including large-scale renewable generation resources and distributed energy resources, which include end-use efficiency and demand response. Electricity markets should be designed to recognize and fairly compensate the full value of the services that these resources can provide, including energy and ancillary services. Finally, electricity markets should be designed to recognize and compensate the fluctuating value of these services according to time and location."
- "Electricity markets should be designed to elicit accurate information about the abilities and relative operating cost of each resource on the power system, including renewable generation resources and distributed energy resources. This information should be used by dispatch centers to guide low-carbon and energy saving dispatch. In periods and places with weak competition, market monitoring and regulation should ensure that accurate cost information is estimated and used in market price determination as well as in dispatch."
- "Electricity markets should be implemented so that multiple provinces are covered by each single integrated electricity market footprint, in order to rationalize system operations (dispatch) over wider geographic areas and facilitate integration of variable renewable generation."

[7] Regulatory Assistance Project & Natural Resources Defense Council. (2017). *Renewable energy integration: US experience and recommendations for China*. Available in English and Chinese. Regulatory Assistance Project. https://www.raponline.org/knowledge-center/renewable-energy-integration-us-experience-and-recommendations-for-china/

Clarify and Strengthen Articles Regarding Electricity Dispatch

Overview and Key Issues

Continued efforts to reform dispatch will be important to support efficient system operations and rational investment and to maintain low levels of renewable energy curtailment. Several laws and policies currently in effect in China address electricity dispatch. Existing law in China uses different terms for dispatch reform:

- The Air Law, as revised in 2015, requires implementation of "green dispatch."
- The draft Energy Law, as publicized in 2020, requires "energy-saving and low-carbon power dispatch and system operations."

In addition, a number of major policy statements have addressed these concepts:

- Document 9, Opinions on Deepening Electricity Reforms (关于进一步深化电力体制改革的若干意见; March 2015) calls for "scientific dispatch" (科学调度; Article 5).
- The U.S.-China Joint Presidential Statement on Climate Change, issued in September 2015, in which China commits to "promote green power dispatch, giving priority, in distribution and dispatching, to renewable power generation and fossil fuel power generation of higher efficiency and lower emission levels."

Recommendations from an International Perspective

We recommend the following options for consideration in the Electricity Law regarding generator dispatch:

- The Electricity Law should include a provision that further defines energy-saving and low-carbon power dispatch and system operations. We suggest the definition could be phrased as follows: "'Energy-saving and low-carbon power dispatch and system operations' refers to security-constrained economic dispatch that minimizes operating costs of system resources, including the social costs associated with various types of emissions."
- We also recommend specifying that "green dispatch" and "scientific dispatch" have the same meaning as "energy-saving and low-carbon power dispatch and system operations." This would bring the Electricity Law and other law and policy into alignment and would reduce confusion regarding terminology.
- Furthermore, we recommend that the Electricity Law include the following provision: "Each regional grid dispatch center should implement unified energy saving and low-carbon power dispatch to its respective regional grid so that least-cost and least-emission resources are prioritized, regardless of provincial location within the region, subject to security constraints."

Strengthen Language Regarding Power Sector Planning and Its Relationship to Electricity Markets

Overview and Key Issues

Improved planning is essential to help move the power sector away from a model in which meeting rapid demand growth is the prime consideration — and toward a model based on careful consideration of complex trade-offs and multiple targets, including China's goals for renewable energy, environmental quality, affordability and reliability. Electricity markets, planning, regulation, demand-side management, air-quality management, electricity pricing, electrification policy, etc., should be tightly coordinated to cost-effectively meet overarching goals for energy revolution and power sector reform. These policy areas need to be coordinated and should not be designed in isolation.

Recommendations from an International Perspective

We suggest that the revised Electricity Law clarify the role of various types of power sector planning and clarify the relationship to electricity markets. The National Energy Administration's (NEA) June 2016 Power Sector Planning Regulation is an important milestone.[8] We recommend supporting this regulation in the framework of the revised Electricity Law. In particular, we draw attention to the following parts of the NEA regulation:

- The planning regulation stipulates a rolling five-year schedule for power sector planning, including recurring tasks for research, preparation, publication, implementation, adjustment and evaluation. It would be very worthwhile to include requirements in the Electricity Law for periodic evaluation and adjustment of the power sector plans, at both the provincial and national levels.
- The planning regulation also requires a rolling process for comment from experts, market participants and other stakeholders.
- The planning regulation emphasizes the concepts of "coordination" and "integration." It requires integration of national and provincial planning efforts. It provides for much-needed coordination in planning for hydro, coal, gas, wind, solar and other generation investments. It also stresses coordination of transmission and generation planning. In addition, it requires strengthened environmental impact assessment and, more broadly, better links between power sector planning and environmental planning.

[8] National Energy Administration. (2016). 国家能源局关于印发《电力规划管理办法》的通知 http://zfxxgk.nea.gov.cn/auto84/201606/t20160606_2258.htm. For discussion, see Dupuy, M., & Xuan, W. (2016). *Excess coal generation capacity and renewables curtailment in China: Getting with the plan*. Regulatory Assistance Project. https://www.raponline.org/blog/excess-coal-generation-capacity-and-renewables-curtailment-in-china-getting-with-the-plan/

- The planning regulation says that markets should be designed to operate in line with "guidance" provided by the plan.
- Finally, the planning regulation new policy even stipulates that power sector planning be coordinated with planning in other key sectors, including land use, urban construction, environmental protection, water resource use, transport, gas supply and heat supply.

We recommend that the law should indicate what entity or entities are responsible for planning (and, if more than one, how their planning is integrated) and what entities are responsible for implementation of the plan. Furthermore, it would be useful to encourage transparency in transmission planning. In a market environment, the transmission planning process will need to become more open and transparent to provide market participants with information so that they can make rational decisions regarding investments in, and siting of, generation and other resources.[9]

We recommend that the entity responsible for long-term, least-cost plans for power sector investment should also be charged with market oversight and given the ability to provide input on market design (that is, the rules and regulations that govern market operation). Such plans would be designed, as required by the NEA planning regulation, to achieve express public policy goals (among them, reliable service, environmental protection, climate change mitigation and universal service, all at the lowest expected least cost to society over the planning horizon), and the means by which the plans are implemented (e.g., regulatory directives, performance-based regulatory methods, and markets carefully designed to achieve desired outcomes) should all fall within the authority of the named regulatory body to assure compliance.

Finally, we suggest including a provision in the Electricity Law that requires incorporation of risk management analysis into power sector planning. In a world of uncertain electricity demand growth and rapidly changing costs, risk management analysis can help manage costs and rationalize investment. There are multiple tools that planners in China can draw on — from scenario analysis to option value analysis — to better incorporate risk management into generation planning. Doing so would reduce the risks, for example, of overinvestment in coal generation due to demand forecast error or fuel cost forecast error.

[9] Such a planning process should include published planning criteria (reliability, economic, policy) that guide transmission investment decisions. U.S. regional transmission operators' transmission plans may be a useful reference, although U.S. transmission planning and investment practices have many shortcomings and are continuing to evolve. See, for example, ISO New England. (n.d.) *Regional system plan*. https://www.iso-ne.com/system-planning/system-plans-studies/rsp/. Also see Pfeifenberger, J., & Chang, J. (2016*). Well-planned electric transmission saves customer costs: Improved transmission planning is key to the transition to a carbon-constrained future*. The Brattle Group. https://hepg.hks.harvard.edu/files/hepg/files/wires_brattle_report_transmissionplanning_june2016.pdf; and Eto, J. (2017). *Planning electric transmission lines: A review of recent regional transmission plans*. Lawrence Berkeley National Laboratory. https://www.energy.gov/sites/prod/files/2017/01/f34/Planning%20Electric%20Transmission%20Lines--A%20Review%20of%20Recent%20Regional%20Transmission%20Plans.pdf

Include Provisions Regarding Electrification and Flexibility of Electrified End Uses

Overview and Key Issues

In various countries around the world, electricity law and policy are increasingly addressing the issue of electrification. Unlocking the flexibility of electrified end uses is an important issue because that flexibility can help support the integration of renewable energy into the power system. China has emerged as a world leader in certain aspects of electrification — notably uptake of electrified transportation — and there is potential for China to become a world leader in the power sector reforms needed to revamp the way that electrified vehicles and other electrified end uses interact with the power grid.

Unlocking the flexibility of electrification — and unlocking cost savings — will depend on electricity price designs, new market mechanisms and other policies that allow electricity consumption to react to conditions on the grid. Here again, the wholesale electricity spot markets under development in various provinces can play an important role, if well designed, by identifying and signaling times and places on the grid where costs are high or low. In addition, technologies, platforms and policies that support efficient two-way interaction between electric vehicle batteries and the grid can play a very important role.

The need for flexibility of electricity consumption means that good retail electricity price design is important. Policies to encourage electrification should be pursued in tandem with new price designs that seek to incentivize efficient use of the electricity system. These include time-of-use tariffs (which have a long history in certain industrial and commercial sectors in China but could usefully be expanded, including to residential consumers) and demand response programs that offer economic incentives to end users for flexible consumption.[10]

Recommendations from an International Perspective

Options for additional provisions in the Electricity Law include the following:

- "We encourage all localities to take measures in consideration of their local conditions to steadily promote the electric power substitution in key areas including transportation, buildings and industry."
- "Responsible agencies should develop indicators and development strategies for electrification in industry, transportation and building sectors and incorporate them into economic and social development plans."

[10] For additional information, see Regulatory Assistance Project. (2020). *Roadmap for electric transportation.* https://www.raponline.org/ev-roadmap/; and Dupuy, M., & Kahrl, F. (2020). *Electrification and power sector reform: Coordinating dual challenges.* Regulatory Assistance Project. https://www.raponline.org/knowledge-center/electrification-power-sector-reform-coordinating-dual-challenges/

- "The country should encourage the development of smart and low-carbon power systems and the development of flexibility of electrified end uses in buildings, transportation and industry to support the grid integration of wind and solar energy. Technologies, platforms and policies to support vehicle-to-grid interaction are also strongly encouraged." (This could fit best under Provision 18 of Chapter 3, Power Production and Grid Management.)

Finally, we recommend providing increased clarity regarding time-of-use pricing (see the next section).

Clarify and Strengthen Provisions Regarding Distributed Energy Resources

Overview and Key Issues

Countries around the world are working to unlock the value of the services that distributed energy resources (DERs) can provide. DERs include demand response, distribution-level and customer-sited energy storage, and distributed generation. The challenge is to set up a framework that unlocks the full value of the services that these resources can provide. Demand response, in particular, can be a plentiful, low-cost and highly flexible resource and can provide a range of services. In addition to its traditional role of shedding load, it is also capable of operating very flexibly on shorter timescales.

Recommendations from an International Perspective

The draft revisions include a new provision requiring "support for clean distributed power generation and encouragement of demand-side management" (Article 6 of revised draft version). Based upon experience in the United States, we suggest the following options:

- Revising Article 6 to require "support for clean distributed energy resources (DERs)" and defining the term "clean DERs" as comprising distributed renewable energy generation, distributed storage resources, demand response and energy efficiency resources.
- Requiring creation of a level playing field for distributed resources. More specifically, it would be useful to require design of spot markets to include rules allowing participation of distributed resources, including through aggregation of distributed resources.

The current version of the Electricity Law includes a requirement for implementation of "time-of-use pricing." This is a very important provision to motivate efficient investment in, and use of, DERs. We suggest that the revised Electricity Law should include a provision encouraging expansion of time-of-use rates to include a wider range of end users, including industrial, commercial and residential customers. It would also be useful to require that time-of-use rates should be designed to support efficient grid management and support grid integration of variable renewable energy by reflecting the cost of providing electricity at different times of the day and year.

Appendix: Selected Examples of Law in Other Countries

This appendix offers a selection of relevant examples from existing legislation in various countries. Because of the very wide breadth of the topic, these examples are intended to be representative and to offer possible starting points for further discussion and research.

European Union

Since the late 1990s, the EU has worked to harmonize industry structure and create the foundations for an EU-wide internal market in electricity. EU directives require all Member States to: create competitive wholesale markets for generation; open the electricity retail sector to competition and liberalize retail prices; unbundle transmission, distribution and generation; ensure nondiscriminatory generator dispatch and provide nondiscriminatory third-party access to the grid network through the creation of independent system operators; develop market mechanisms to allocate intertie capacity; and establish dedicated, independent regulators for the energy sector.[11]

The EC's Third Energy Package (Directive 2009/72/EC) set out institutions to facilitate greater coordination among national regulators and further national cooperation on cross-border transmission. In particular, it led to the creation of the European Agency for the Cooperation of Energy Regulators in 2010. The agency's mandate is to coordinate among national regulators, participate in the development of regional transmission infrastructure and rules and monitor regional markets.[12]

The recently adopted Clean Energy for All Europeans package puts a renewed focus on scarcity pricing and its significance for achieving reliability. According to the Electricity Regulation on the internal market for electricity: "To support this shift to variable and distributed generation, and to ensure that energy market principles are the basis for the Union's electricity markets of the future, a renewed focus on short-term markets and scarcity pricing is essential." The regulation goes on to stipulate that any price caps should be lifted to allow for the formation of scarcity pricing.[13]

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[11] These requirements were formulated in three directives spanning 13 years: Directive 2009/72/EC in 2009, Directive 2003/54/EC in 2003 and Directive 96/92/EC in 1996. See European Commission. (2011, March 2). *Questions and answers on the third legislative package for an internal EU gas and electricity market.* http://europa.eu/rapid/press-release_MEMO-11-125_en.htm?locale=en

[12] See European Agency for the Cooperation of Energy Regulators. (n.d.) *About electricity.* https://www.acer.europa.eu/en/Electricity/Pages/default.aspx

[13] European Commission. (2019). *Commission Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity (recast).* https://eur-lex.europa.eu/eli/reg/2019/943/oj

Germany

As part of the Energiewende effort to transform the power sector, Germany revised a number of laws, including:[14]

- Renewable Energy Sources Act
  - Sets out capacity targets for renewable energy, by type.
  - Creates a competitive capacity auction mechanism to be used to reach those targets, which replaces the feed-in tariff approach.
  - Designates the Federal Network Agency (a central government agency) as responsible for administering and overseeing the competitive bidding.
  - Specifies requirements for bidders to take part in the auctions: bidders must meet criteria to demonstrate technical competency and make security deposits to ensure that winning projects are quickly realized.
  - Requires that power from renewables in areas of grid congestion should be deployed for district heating networks if power would otherwise have to be curtailed.
  - Sets out limits on new wind capacity in places where the transmission grids are overloaded.
  - Includes measures to better coordinate planning for grid expansion and for renewables expansion.
- Electricity Market Act
  - Stipulates two power market segments: the energy-only market, in which quantities of electricity (MWh) are traded for different delivery times, from 15 minutes to years in advance; and the reserve markets, which provide standby capacity (MW).
  - Specifies mechanisms to incentivize flexible resources to support renewables.
  - Sets out provisions for demand-side management and requires that demand-side resources be treated in a manner roughly equivalent to conventional generation capacity in planning processes.
  - Allows special service providers to sell load-shifting potential to the balancing energy market.
- Act on the Digitization of the Energy Transition
  - Includes provisions regarding smart meters.
- Federal Requirement Plan Act
  - Includes a list of urgent transmission-grid expansion projects.
- Combined Heat and Power Act
- Incentive Regulation Ordinance
  - Roughly parallel to “transmission and distribution pricing” in China.

[14] Agora Energiewende. (2016). *Energiewende: What do the new laws mean?* https://www.agora-energiewende.de/en/publications/energiewende-what-do-the-new-laws-mean/

  - Sets out the design of pricing mechanisms to motivate grid companies to support clean energy goals.

- Energy Industry Act
  - Stipulates that transmission system operators can sign agreements with combined heat and power (CHP) operators in grid expansion areas requiring that they ramp down their own electricity production and instead use renewable electricity to generate the needed heating via a power-to-heat facility. (CHP operators are compensated for the investment costs in a power-to-heat facility.)

United States

Electricity Markets and Economic Dispatch

The Federal Energy Policy Act of 2005 was written with the understanding that the power system in the U.S. already operates according to the principles of economic dispatch but could be improved. The act requires the U.S. Department of Energy to study "economic dispatch" and report on the scope to refine dispatch procedures in order to treat various resources fairly and lower overall system costs.[15]

Public Utility Regulatory Policies Act

This act, enacted in 1978 and amended several times since, requires state officials to analyze several types of policies and implement as necessary. These policies include:[16]

- Block rates (known as tiered pricing in China).
- Time-of-day rates ("time-of-use" pricing).
- Seasonal rates.
- Interruptible rates.
- Load management.
- Integrated resource planning.
- Investments in conservation and demand management.
- Energy efficiency investments in power generation and supply.
- Net metering.
- Rate design modification to promote energy efficiency investments.

[15] 42 U.S. Code, Title 42, Chapter 149, Subchapter XVI, § 16524 — Study on the benefits of economic dispatch. https://www.law.cornell.edu/uscode/text/42/16524

[16] 16 U.S. Code, Title 16, Chapter 46, Subchapter II, § 2621 — Consideration and determination respecting certain ratemaking standards. https://www.law.cornell.edu/uscode/text/16/2621

- Consideration of smart grid investments.

Texas State Law

Texas law[17] requires that "the protocols and other rules and requirements of the [electricity markets] ... shall be developed with consideration of microeconomic principles and shall promote economic efficiency in the production and consumption of electricity. ... [The market and system operator organization] shall determine the market clearing prices of energy and other ancillary services ... using economic concepts and principles such as ... marginal cost pricing." The law further requires design and implementation of specific "scarcity pricing mechanism" in the electricity market to ensure that these principles are met. Although the Texas law provides much more detail than is likely to be used in China's Electricity Law, the Texas case may be a useful reference.[18]

Integrated Resource Planning

There are useful examples from the United States of legislation in several relevant areas. The Northwest Power Act of 1980 was a very early and important example: It established energy conservation as the "priority resource" for the northwestern states and has since been a very important driver of power sector planning and resource acquisition in the region, displacing significant amounts of power plant capacity with investments in end-use energy efficiency.[19] The act established the Northwest Power and Conservation Council to lead the planning efforts in the region (consisting of four states: Washington, Oregon, Idaho and Montana). The act includes the following provisions:

- The plan must achieve an "adequate, efficient, economical and reliable power supply" at the "least cost." Here, "cost" is defined to include all costs associated with a resource over its life, including the costs of the impacts of pollution and other environmental damage to society.[20]
- The plan must treat end-use energy efficiency as a resource; that is, it must compare energy efficiency directly to conventional generation resources and establish that mix (portfolio) of resources that will meet demand for energy service at the lowest cost over the long term.
- Energy efficiency is declared to be a "priority" resource. The law defines the concept of a "loading order," a protocol to guide new investment decisions. The loading order gives preference to resources for their environmental and economic benefits. Resource acquisition must begin with end-use energy efficiency and is followed in turn by renewable resources, resources with high fuel

[17] Texas operates its main electricity system in a manner that is not synchronized or substantially interconnected with the rest of the United States. As a result, the main Texas electric system and electricity market are not subject to key provisions of U.S. federal law such as oversight by federal electricity regulators. As a result, Texas state law regarding electricity markets can be thought of as a useful comparator for national law.

[18] Texas Administrative Code, Chapter 25, Subchapter S. Wholesale Markets. http://txrules.elaws.us/rule/title16_chapter25_subchapters

[19] Pacific Northwest Electric Power Planning and Conservation Act, Pub. L. No. 96–501, 94 Stat. 2697 (1980). https://uscode.house.gov/view.xhtml?path=%2Fprelim%40title16%2Fchapter12H&req=granuleid%3AUSC-prelim-title16-chapter12H&f=&fq=&num=0&hl=false&edition=prelim

[20] Environmental damage costs are one type of "external" cost or "externality." They are called "externalities" because their costs are not reflected, either fully or in part, in the market for the good or service in question. But there is no question that they constitute real costs to society — through illness, reduced productivity, destruction of natural resources and so on — and these costs should be accounted for during the planning process.

conversion efficiencies (such as CHP) and, finally, other more traditional resources, such as natural gas-fired plants.

Many state legislatures have passed laws that include requirements for integrated resource planning. For example, Vermont law includes the following provisions regarding "least cost integrated planning":[21]

- Plans must consider "energy supply, transmission, and distribution capacity, transmission and distribution efficiency, and comprehensive energy efficiency programs."
- "Comprehensive energy efficiency programs" are defined as "investments or program expenditures … to meet the public's need for energy services through efficiency, conservation or load management."
- Calculations of economic costs must include costs associated with greenhouse gas emissions.

[21] Public Service: State Policy; Plans; Jurisdiction and Regulatory Authority of Commission and Department, 30 V.S.A. (Vermont Statutes Annotated) § 218c. http://legislature.vermont.gov/statutes/section/30/005/00218c

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