UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Integration of Variable Energy Resources	**)** **)**	**Docket No. RM10-11-000**

COMMENTS OF THE SOLAR ENERGY INDUSTRIES ASSOCIATION

The Solar Energy Industries Association (SEIA) submits these comments in response to the Federal Energy Regulatory Commission's (Commission) Notice of Inquiry (NOI) on Integration of Variable Energy Resources (VERs) dated January 21, 2010.[1] SEIA welcomes the opportunity to comment on the NOI and commends the Commission's willingness to tackle the complex issues associated with removing barriers to integration of VERs into the transmission grid.[2]

I. Overview and Summary of Comments

A. SEIA

Established in 1974, the Solar Energy Industries Association is the national trade association of the solar energy industry. As the voice of the industry, SEIA works with its 1,000 members to make solar a mainstream and significant energy source by expanding markets, removing market barriers, strengthening the industry and educating the public on the benefits of solar energy. SEIA represents solar companies across a variety of solar energy technologies,

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[1] *Integration of Variable Energy Resources*, 130 FERC ¶61,053 (2010).

[2] In addition, we have reviewed the comments of the American Wind Energy Association, and we note our general support for them.

including photovoltaic, solar water heating and concentrating solar power (CSP). SEIA members include manufacturers, distributors, contractors, installers, financiers and developers of solar energy projects on both the wholesale and retail level.

B. Overview of Comments

Three themes frame SEIA's detailed responses to the Commission's NOI. First, the Commission must implement VER integration in a least-cost, least-emissions manner that improves the overall reliability of the grid. Second, the Commission must coordinate this NOI with other ongoing policy initiatives at the state and federal level to promote renewable deployment. Third, the Commission should adopt a VER integration policy that is sufficiently flexible to accommodate regional and technological differences and to incorporate the results of ongoing research on solar forecasting or the role of storage in facilitating VER integration. We elaborate on these points below.

1. VERs must be integrated in a least-cost, least-emissions manner that builds robust markets for products to contribute to overall grid reliability

This NOI represents an enormous opportunity for the Commission to "do integration right." Integrating VERs in a just, reasonable and not unduly discriminatory manner, as the Commission proposes in the NOI, is an important goal. But equally important, VER integration must also be implemented in a least-cost, least-emissions manner that enhances wholesale electric competition and permits renewable energy suppliers to become active participants in those markets as a growing number of states and, potentially, the federal government,

adopt renewable energy mandates.

In formulating a VER integration policy the Commission must not lose sight of these big-picture goals. For example, while integration of VERs might be achieved relatively inexpensively through reliance on conventional, peaking generation resources as reserves, encouraging this type of practice is counter-productive. Reliance on emissions-generating resources undermines the intended environmental benefits of renewables generation and stands at odds with state renewables portfolio standard (RPS) policies to promote generation of renewables energy. Likewise, failing to provide financial incentives to the renewables industry to improve efficiencies or develop valuable products and services that can contribute to the reliability of the grid would, in the long run, weaken both the reliability of the grid and the renewables industry itself. Financial incentives to develop the reliability products and services that the grid needs will foster innovation and enable VERs to attract new sources of capital, thereby ensuring continued growth, improved grid reliability, and just and reasonable rates.

2. The NOI represents a piece of larger strategy to promote renewables and improve grid reliability

The NOI relates to many other ongoing policy initiatives taking place in the states (renewable portfolio standard or RPS), Congress (efforts to open the transmission planning process, expedite transmission siting and address cost allocation issues)[3] and before the Commission (demand response,[4] transmission

[3] *See American Clean Energy & Security Act of 2009*, Title I, Subtitle F, H.R. 2454, 111th Cong. (2009) (as passed by House of Representatives June 26, 2009), *available at* http://www.govtrack.us/congress/bill.xpd?bill=h111-2454; *American*

planning,[5] smart grid, and transmission incentives for energy storage or batteries[6]). Collectively, these policy initiatives will expand renewables' ability to access the grid and improve both the reliability of the grid and the predictability of VERs, thereby facilitating their integration. Though these efforts are moving ahead in separate dockets, the Commission must coordinate these multiple activities and leverage programs within its jurisdiction to further promote VER integration.

3. The Commission should act flexibly in implementing VER integration because much still remains unknown

As VER penetration increases, several studies are examining the impacts of increased integration on system reliability, and operating costs.[7] In fact, just two weeks ago, the California Public Utilities Commission (CPUC) announced

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Clean Energy Leadership Act of 2009, Title I, Subtitle B, S. 1462 111th Cong. (2009), *available at* http://thomas.loc.gov/cgi-bin/query/z?c111:S.1462

[4] *Demand Response Compensation in Organized Wholesale Energy Markets*, 130 FERC ¶ 61,213 (2010).

[5] *Transmission Planning Process Under Order No. 890*, Notice of Request for Comments, Docket No. AD09-8-000 (October 8, 2009) (seeking comments on improvements to transmission planning process).

[6] *See, e.g.*, *Western Grid Dev., LLC*, 130 FERC ¶ 61,056 (2010) (granting incentives for energy storage technologies); *Pacific Gas & Elec. Co.*, 129 FERC ¶ 61,251 (2009) (applying smart grid policy statement principles to award incentives for synchrophasors); *Smart Grid Policy Statement*, 128 FERC ¶ 61,060 (2009).

[7] *See, e.g.*, North American Electric Reliability Corporation, *Accommodating High Levels of Variable Generation* (April 2009), http://www.aeso.ca/downloads/IVGTF_Report_041609(1).pdf [hereinafter *NERC Report*]; R. Piwko, K. Clark, L. Freeman, G. Jordan & N. Miller, *Western Wind and Solar Integration Study: Draft Executive Summary (February 2008-February 2010)* (February 2010), http://wind.nrel.gov/public/WWIS/DraftExecSumm.pdf [hereinafter *NREL Integration Report: Draft Executive Summary*].

the award of a $2.875 million grant to NREL to focus on development of tools to improve integration of photovoltaics into the utility grid.[8] The results of those integration studies already completed are encouraging, with systems demonstrably capable of accommodating an increase of up to 20 or 30 percent of VER resources.[9]

Other tools that can enhance accurate scheduling and bring integration costs down—such as state of the art forecasting or smart grid— are dynamic engineering areas. In particular, forecasting techniques for solar resources are the subject of study at NREL, RTOs and universities.[10] The results of these studies may influence the Commission's policy choices in this NOI

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[8] National Renewable Energy Laboratory, *NREL to Help California Tackle Solar Energy Grid Integration: Renewable Energy Laboratory Picks Up $2.7 Million in Grants* (March 30, 2010), http://www.nrel.gov/news/press/2010/826.html.

[9] *See NREL Integration Report: Draft Executive Summary*, *supra* note 7 at 8-10 (concluding that West Connect region can accommodate 30 percent wind/5 percent solar through more coordination between balancing areas and improvements in accuracy of forecasting); *see also* Paul Denholm, Erik Ela, Brendan Kirby & Michael Milligan, *The Role of Energy Storage with Renewable Electricity Generation (NREL/TP-6A2-47187)* (January 2010), http://www.nrel.gov/docs/fy10osti/47187.pdf at 46 ("To date, integration studies of wind to about 20% on an energy basis have found that the grid can accommodate a substantial increase in variable resources . . . but 30% or more appears feasible with the introduction of "low-cost" flexibility options such as greater use of demand response.").

[10] *See, e.g.*, Atmospheric Sciences Research Center, State University of New York at Albany, *Papers by Richard Perez on Resource Assessment, Satellites and Forecasting*, http://www.asrc.cestm.albany.edu/perez/directory/ResourceAssessment.html (last visited April 3, 2010); U.S. Department of Energy, *Solar Energy Technologies Program: Solar Resource Forecasting*, http://www1.eere.energy.gov/solar/forecasting.html (last visited March 31, 2010) [hereinafter *Solar Resource Forecasting*].

Best integration practices may also vary regionally or by technology. For that reason, a series of technical conferences may assist in determining or refining specific regional or technology-specific integration practices.

C. Summary of Specific Recommendations

- The Commission must implement a VER integration policy in a least-cost, least-emissions manner that improves reliability of the grid, and encourages VERs to participate fully in competitive wholesale electric markets.

- Improved forecasting practices can facilitate integration of VERs in a cost-effective, least-emissions manner. Forecasting practices for the solar industry are still developing, with research activities and regional efforts ongoing. The Commission should create incentives to encourage improved forecasting practices while remaining sufficiently flexible to incorporate the results of ongoing research activities and regional efforts and avoid imposing undue burdens on VER generators.

- Currently, operators rely on expensive peaking generation as reserves to balance system variability. The Commission should encourage lower-cost, emission-free solutions such as increased scheduling efficiency, demand response and Smart Grid solutions to improve scheduling accuracy and facilitate VER integration.

- The Commission must continue to exempt VERs from third tier penalties, and instead offer economic incentives to encourage improved scheduling practices.

- Larger balancing areas or coordination between balancing areas are critical to increasing absorption of renewables into the grid. Encouraging increased coordination between balancing areas is a preferred alternative to creating virtual balancing authorities, which may prove a protracted and complicated process.

- Reserve products play an important role in maintaining system reliability while integrating additional VERs. The Commission should encourage development of products to improve reliability, but first should inventory existing products to avoid duplication of effort.

- The Commission should expand Order No. 661 to solar generators and other VERs to minimize the capital costs of renewable technologies (which could be increased if they are required to provide reactive power) and assure parity amongst all VERs.

- The Commission should ensure opportunities for VERs to participate in capacity markets, as it has done for other generators and demand response providers.

II. Background

The solar energy industry has enormous potential; at the same time, it faces significant challenges. To date, the Commission has addressed these issues in some initiatives, which are briefly described below.

A. The Potential of Solar Power

1. The growth of the solar industry

The solar energy industry has expanded rapidly over the last decade, with installations increasing at a compound annual growth rate of more than 36 percent, and stands poised for even more tremendous growth.[11] The rapidly declining cost of solar energy, renewables portfolio standards (RPS) in 29 states and the District of Columbia (with California's particularly aggressive 30 percent renewables requirement by 2020)[12] and federal stimulus incentives are driving solar power development at an unprecedented pace.

As of July 2009, there were 550 MW of grid-tied concentrating solar power (CSP) capacity worldwide, with more than 75 percent (419 MW) of this capacity located in the southwestern United States.[13] By that date, global installed PV capacity reached 13.9 GW, with 1.1 GW of PV capacity located in the United States.[14] Moreover, the momentum of the solar industry is increasing; currently,

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[11] SEIA, *U.S. Solar Industry Year in Review 2009*, (forthcoming April 2010)(to be available online at www.seia.org).

[12] On November 17, 2008, Governor Arnold Schwarzenegger signed Executive Order S-14-08, *available at* http://www.gov.ca.gov/executive-order/11072/, which requires that California utilities reach the 33 percent renewables goal by 2020.

[13] United States Department of Energy, Office of Energy Efficiency and Renewable Energy, *2008 Solar Technologies Market Report* (January 2010) at 10 [hereinafter *2008 Solar Technologies Market Report*].

[14] *Id*. at 9.

17,436 MW of utility-scale solar power projects (10,836 MW of CSP and 6,600 MW of photovoltaics) are under development.[15]

Technological advances have slashed the cost of solar energy, reducing the installed costs of photovoltaic systems by 31 percent between 1998 and 2008,[16] excluding the impacts of tax incentives and subsidies, while the price of concentrating solar power (CSP) has declined from 44 cents per kilowatt hour for the first plant built in the 1980s to roughly 15 to 16 cents per kilowatt hour today.[17]

The American Recovery and Reinvestment Act of 2009[18] (ARRA) programs are also driving renewable development. ARRA's suite of tax incentives and credits, renewable energy grants, and loan programs create new funding sources for renewables projects and provide strong incentive for private investment in the renewables industry.[19] In addition, ARRA's renewable energy manufacturing investment tax credit for new investment in advanced energy manufacturing fosters development of infrastructure necessary for continued growth of the renewables industry and contributes to the creation of green jobs

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[15] *Utility-Scale Solar Projects in the United States, Operational, Under Construction, and Under Development*, SEIA, http://www.seia.org/galleries/pdf/Major%20Solar%20Projects.pdf (Updated 3/18/2010) .

[16] Ryan Weiser, Galen Barbose & Carla Peterman, *Tracking the Sun II: The Installed Cost of Photovoltaics in the U.S. from 1998-2008* (February 2009), http://eetd.lbl.gov/ea/EMS/reports/lbnl-1516e.pdf at 9.

[17] *Building a Solar Future*, Environment America (March 2010) at 42.

[18] Public Law 111-5.

[19] *2008 Solar Technologies Market Report*, *supra* note 13, at 80-85 (describing ARRA tax credits, loan programs and incentives).

within the United States. ARRA is also funding smart grid programs, which, as discussed later in these comments, can improve grid responsiveness and aid in the integration of VERs.

2. The benefits of solar power

In addition to creating domestic jobs, solar power deployment also offers other benefits, including reduced emissions, operational cost savings, and capacity value. A recent NREL Report preliminarily concluded that CO_2 emissions in the WECC Region would be reduced by nearly 120 million tons per year under a scenario of 30% wind and 5% solar penetration. SO_X emissions would be reduced by approximately 45,000 tons and NO_X would be reduced by nearly 100,000 tons.[20]

The NREL report also found that a 30 percent wind/5 percent solar penetration scenario in the WECC produced operating cost savings of $20 billion per year due to the wind and solar generation resources.[21] Developing national policies that foster increased VERs integration—specifically wind and solar—will allow all regions to experience the benefits enjoyed by the WECC area.

Finally, PV and CSP plants contribute capacity as well as energy to the system. PV solar plants have capacity values in the range of 14 to 33 percent, depending on configuration and location, while CSP plants have capacity factors in the mid-20 percent range without thermal energy storage, and near 40 percent

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[20] *NREL Integration Report: Draft Executive Summary*, *supra* note 7, at 15.

[21] *Id*.

with storage.[22] This capacity resource provides further benefits to the bulk power system.

C. Challenges Facing the Solar Industry

The momentum of utility-scale solar power is threatened by challenges such as access to adequate transmission, regulatory uncertainty regarding appropriate cost allocation for new transmission, and protracted permitting processes for generation projects.

[22] *2008 Solar Technologies Market Report at 55.*

1. Need for adequate transmission

Above all, the renewables industry faces an urgent demand for timely construction of adequate transmission. As SEIA emphasized in its joint whitepaper with AWEA, *Green Power Superhighways: Building a Path to America's Clean Energy Future*,[23] transmission is critical for the growth renewable energy. According to the whitepaper:

> There are more than 4,000 MW of large solar power plants scheduled for construction in the next five years, most of which require new or significant upgrades to the transmission grid. The California Public Utilities Commission has identified lack of adequate transmission as the primary barrier utilities face in meeting their Renewable Portfolio Standard. Even when the utilities have signed contracts with renewable generators, the lack of transmission can delay or prevent projects from being built . . . .[24]

Geographic factors compound the transmission problem for solar power. CSP plants require high sunlight levels and therefore, are geographically limited to flat, arid parts of the country, primarily the Southwest.[25] Similarly, while PV systems will operate anywhere, a system located in the southwestern United States can produce up to twice as much electricity as the same system located in

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[23] Solar Energy Industries Association & American Wind Energy Association, *Green Power Superhighways: Building a Path to America's Clean Energy Future* (February 2009), http://seia.org/galleries/pdf/GreenPowerSuperhighways.pdf.

[24] *Id.* at 5.

[25] Paul Komor, *Wind and Solar Electricity: Challenges and Opportunities* 10 (Pew Center on Global Climate Change 2009), *available at* http://www.pewclimate.org/report/Wind-Solar-Electricity/June2009.

the northeast.[26] As such, transmission is required to deliver these solar resources to other parts of the country.

2. Cost allocation of transmission

The transmission planning process—specifically, lack of clarity regarding cost recovery and allocation rules—also hinders renewables development. Without clear rules on cost recovery, few entities will take the risk of making extensive investments in either solar resources or the transmission facilities to deliver them. In October 2009, SEIA filed extensive comments in Docket No. AD09-8, *Transmission Planning Processes Under Order No. 890*, seeking: (1) development of formal metrics to determine which transmission projects are eligible for cost recovery and (2) adoption of a beneficiary-pays approach to cost allocation and recovery.[27] Those comments also sought rolled in rate treatment of high voltage trunklines to integrate remote and renewable energy projects to meet state RPS requirements; and explicit guidance that rate based cost recovery will be allowed for transmission projects sized to meet renewable energy development so long as there is sufficient demonstration of need for the line.[28] SEIA understands that the Commission will address cost recovery issues as part of this separate docket, and as such, these comments will not discuss cost allocation in any further detail.

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[26] *Id*.

[27] SEIA Comments, Docket No. AD09-000 at 2.

[28] *Id*.

3. Permitting Hurdles

Though not within the Commission's jurisdiction, solar projects face significant permitting hurdles, which add costs and delay development. Planning and permitting barriers that can hinder solar development include: (1) complex and unclear local permitting requirements; (2) permitting requirements that vary significantly across jurisdictions, as well as from one jurisdiction to another; and (3) costly environmental studies or permit fees.[29] Delays associated with permitting solar projects may complicate the ability of those projects to retain a place in interconnection queues, thus slowing opportunities for growth.

D. FERC Policies

The Commission has made strides in developing policies that foster the growth of VERs in a cost effective and least-emission manner. As described in the NOI, in Order No. 890, the Commission applied a reduced penalty amount to intermittent resources' imbalances (which would otherwise be subject to third tier generation imbalance penalties), recognizing that "intermittent generators cannot always accurately follow their schedules and that high penalties will not lessen the incentive to deviate."[30] In addition, in a subsequent order, the Commission recognized that the difficulties faced by VERs, such as location constraints, support a variation from interconnection pricing policy.[31]

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[29] *2008 Solar Technologies Market Report*, *supra* note 13, at 86 (discussing permitting barriers).

[30] NOI at P 8 (citing Order No. 890, *Preventing Undue Discrimination and Preference in Transmission Service*, FERC Stats. & Regs. ¶ 31,241 at P 64-65, *order on reh'g*, Order No. 890-A, FERC Stats. & Regs. ¶ 31,261 (2007).

[31] *Id*. (citing *California Independent System Operator Corp.*, 119 FERC ¶ 61,061 at P 69-70 (2007)); *see also Southwest Power Pool*, 127 FERC ¶ 61,283 at P 29

Other recent Commission policies that will aid development of VERs and/or integration into the grid include granting incentives for smart grid[32] and storage.[33] As discussed in Part III, both smart grid solutions and storage resources can facilitate integration of VERs.

Finally, on March 18, 2010, the Commission issued a Notice of Proposed Rulemaking (NOPR) seeking comment on whether RTOs and ISOs should pay demand response providers the market price for energy for reducing consumption below their expected levels.[34] Compensating demand resources at market prices is expected to remove disincentives to avoid their use. Robust demand response programs can also assist with VER integration by eliminating excess reserves and reducing reliance on emissions-heavy reserve generation.[35]

(2009) (accepting proposal to allocate network upgrade costs differently for wind resources being used to serve demand in different zone than methodology used for other resources).

[32] *Pacific Gas & Elec. Co.*, 129 FERC ¶ 61,251 (2009) (granting request to recover costs associated with $50 million synchrophasor project to provide real time data on key transmission operating measurements to help integrate VERs).

[33] *Western Grid Development*, *supra* note 6, at 61,056 (approving rate incentives for battery storage devices intended to improve operation and reliability of CAISO).

[34] *Demand Response Compensation*, *supra* note 4, at 61,213.

[35] The NOPR describes that demand response resources helped compensate for inadequate reserves following a sudden drop in power supplied by wind generators in ERCOT and the loss of thermal generation. The system operator called on all demand response resources, and 1200 MW of Load acting as Resource (LaaRs) responded within ten minutes, bringing ERCOT back into balance. *Id.* at n.15.

III. Specific Comments

A. Forecasting

1. Current Solar Forecasting Tools

As the Commission explains, the challenges faced by System Operators in "accurately predicting the exact output of VERs" could become more manageable through development and use of enhanced forecasting tools and procedures, supplied with data from multiple diverse locations.[36] SEIA agrees with, and multiple studies corroborate,[37] the Commission's observation that forecasting can ensure just and reasonable rates by allowing System Operators to schedule generation resources more accurately and to anticipate system ramping events and respond in an economically efficient manner.[38]

Several RTOs and ISOs have adopted centralized wind forecasting systems with state-of-the-art modeling. These systems predict the output of wind resources and incorporate those projections into operation of their day-ahead and real-time unit commitment and dispatch systems.[39]

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[36] NOI at P 14-15.

[37] *NREL Integration Report: Draft Executive Summary*, *supra* note 7, at 12. The study found that using state of the art wind and solar forecasts would reduce annual WECC production costs by $5 billion, compared to ignoring renewables in the day ahead forecast. *Id.* Perfect wind and solar day ahead forecasts would reduce WECC operating costs by another $500 million per year. *Id.*; *see also NERC Report*, *supra* note 7, at 54 (noting that forecasting the output of variable generation is critical to bulk power system reliability).

[38] NOI at P 15-16.

[39] Several ISOs/RTOs, including AESO, CAISO, ERCOT, NYISO, and PJM now have centralized wind forecasting systems with state-of-the-art modeling. These systems better predict the output of wind resources and incorporate those projections into operation of their day ahead and real-time unit commitment and dispatch systems. ISOs/RTOs are establishing advanced operational tools,

Because solar power has not reached the same level of grid penetration as wind, many System Operators have not yet realized a compelling need to adopt a centralized forecasting system for solar. CAISO is leading the way on this front with the Participating Intermittent Resource Program (PIRP), where stakeholders have offered initial recommendations on data acquisition requirements and initial deployment of solar forecasting.

In addition, solar forecasting is a relatively new art and science. Further work is needed to adopt models that are representative of various solar technologies and to allow the meteorological data that is acquired to be translated into the performance forecasting operators require. While forecasting tools are improving, the consensus is that present forecasting tools are not sufficiently tailored to predict solar output for the variety of technologies within the solar sector. Currently, the mean error of solar forecasting methods remains in the 30% range and can vary greatly depending upon geographic region.

Many studies on solar forecasting are currently ongoing, and the results may inform this NOI. For example, NREL is focused on developing forecasting capabilities over various points of time including:[40]

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including visualization of wind conditions, to improve system operators' situational awareness. ISO/RTO Council, *2009 IRC State of the Markets Report* (2009) http://www.isorto.org (follow "Documents and Issues"; then follow "2009 IRC State of the Markets Report" hyperlink) (hereinafter *2009 IRC State of the Markets Report*); *see also New York ISO*, 123 FERC ¶ 61,267 (2008) (amending Service Tariff to add Wind Energy Forecast mechanism, which requires wind plants with nameplate capacity of 12 MW or more to collect data and transmit it to NYISO for forecasting).

[40] *Solar Resource Forecasting*, *supra* note 10. Richard Perez at SUNY Albany is preparing other studies.

- Short-term of less than 1 to 3 hours ahead for regulating frequency and following load;
- Day-ahead for committing generation units;
- Seasonal and annual periods for doing long-term system planning and economic analyses.

2. State-of-the-art generation forecasting for solar and market barriers impeding development

a. Types of data necessary to achieve state of the art generation forecasting

State-of-the-art generation forecasting is varied and technology-dependent. Generally, required data categories include: (1) generation; (2) meteorological (global short-wave irradiance and possibly components depending on type of solar generation facility); (3) availability of generation resources (variations in effective capacity); and (4) site specs (type of generation equipment, location, orientation etc.). Sampling frequency should be less than or equal to desired forecast time resolution (*e.g.*, at least hourly data for forecasts in hourly intervals). In addition, better on-site characterization of cloud cover (*e.g.*, total sky imagers), various solar resource measurements (global horizontal irradiance, direct normal irradiance, and diffuse horizontal irradiance), and improved satellite-based measurements will help improve forecasting tools.

b. Market barriers impeding development

The science of forecasting a solar generator's performance, while still in the early stages, is sufficient to provide a foundation to allow for integration of VERs to move forward. Additional research is required on what types of

systems will facilitate the best forecasting.[41] As the Commission moves forward with this NOI, it should review the results of ongoing studies on forecasting practices and focus on providing market incentives to encourage System Operators to improve and develop forecasting tools.

3. Forecasting tools and processes required by System Operators to address ramping and variations and VERs output

To address ramping and variations in solar output, System Operators will require intra-hour forecasting models. Intra-hourly forecasts will require technologies and models that can provide very high geographic resolution (< 1 km). This will most likely require direct observation of clouds either from ground-based sensors or satellite imagery, or both. It is possible that numerical model only-based data will never be able to properly estimate PV ramp rates, due to the cloud parameters that they rely upon.[42] In addition, there is a need for future research on how to best use ramp forecast information effectively.

4. Size of resources to which submission of forecast data (*e.g.*, operational, outage and meteorological data) should apply

[41] CAISO is experimenting with ways to encourage submission of data by exempting from imbalance penalties VERs that submit forecast data. The NYISO tariff requires wind projects with a nameplate capacity of larger than 12 MW to submit forecast data to the NYISO, with failure to provide information resulting in a penalty. NYISO also allows each participating wind generator access to plant forecasts used in economic dispatch. *NYISO*, 123 FERC ¶ 61,267 (2008).

[42] As noted earlier, Richard Perez at SUNY Albany is doing research on these technologies and models. Likewise, wind energy forecast service providers are currently developing energy forecasting models for solar plants.

SEIA believes that formulating detailed policies for submission of forecasting data is premature at this time. Regional system operators such as CAISO are currently working with VER generators to identify the type of forecasting data required, and the entities to which these requirements should apply. For now, the Commission should defer to ongoing local measures before implementing mandatory data submission policies. Should the Commission determine that mandatory data submission is needed, SEIA stands ready to offer guidance on how to develop and implement such a policy.

5. Public availability and confidentiality of meteorological data

Meteorological data does not necessarily demand confidential treatment. Nevertheless, met data has most value not through wide public disclosure, but when made available to a System Operator or forecast provider for use in developing forecast tools or as input to confidential simplified models specific to the technologies deployed that can predict outcomes of the facilities at each location. Submission of operational data and outage reports requires more protection; VER generators should be required to submit that information only to the System Operator and/or third party forecast provider, subject to non-disclosure agreements.

6. Decentralized v. centralized meteorological and VER energy production forecasting and obligation of transmission providers to have independent forecasting as part of reliability commitment

Generally, centralized meteorological systems are a more cost-effective tool to provide data for forecasting models. Centralized systems usually

perform better since they can integrate data from many VERs for the good of the entire system. Indeed, many ISOs are already using centralized forecasting systems for wind.[43]

Due to the state of emerging solar forecasting practice, it may be premature to imposing independent forecasting obligations on transmission providers that are similar to the providers' obligations in connection with demand forecasting. Ongoing forecasting studies will inform transmission providers' ability to develop forecasting tools and comply with any forecasting requirements.

7. Distributed or behind-the-meter resources may reduce the need for System Operators to rely on reserves

Behind-the-meter resources may not have a significant system impact as long as behind-the-meter VER variability is less than load variability. On the other hand, behind-the-meter resources may mask load, thereby reducing predictability. For this reason, data on behind-the-meter resources is potentially important for efficient system operation and reduced reliance on reserves --- though it is important to strike a balance between the need to gather data to faciliate VER integration and efficient operation and imposing costly data requirements on distributed generators that lack any justifiable purpose.[44]

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[43] *See 2009 IRC State of the Markets Report*, supra note 39 at 29 ("AESO, CAISO, ERCOT, NYISO, and PJM now have centralized wind forecasting systems with state-of-the-art modeling. These systems better predict the output of wind resources and incorporate those projections into operation of their day ahead and real-time unit commitment and dispatch systems").

[44] Types of data that are helpful, and should not be onerous to supply are (1) characteristics of physical factors such as orientation, tilt, tracking and

Should the Commission determine that data on behind-the-meter resources is required to facilitate VER integration, SEIA can assist in providing additional guidance.

B. Scheduling and Flexibility

1. Need for scheduling flexibility

The Commission observed that, as VERs increase in penetration, System Operators appear to be relying more on expensive reserves to balance variation in output.[45] Reliance on more expensive peaking reserve generation may increase rates (as the Commission suggests)[46] and may also reduce the environmental benefits of aggressive state renewable energy policies. Therefore, SEIA supports the Commission's decision to explore in this NOI whether greater scheduling flexiblity could provide system benefits and faciliate reliable and efficient use of all resources. In particular, the Commission should focus on demand response and Smart Grid solutions to balance reserves against renewables.

2. Impact of shorter scheduling intervals on flexibility and ability to manage VER ramp and demand

Scheduling and flexibility are necessary to allow System Operators to accommodate larger amounts of VERs and more efficiently manage variability. Shorter scheduling intervals allow System Operators to more efficiently manage

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perhaps efficiency and (2) a representative sample of the generation (though not necessarily every site).

[45] NOI at P 17.

[46] NOI at P 21.

VER ramp rates and reduce reliance on reserves to manage VER fluctuations.[47] Further, scheduling issues should be addressed across balancing areas, as coordination will allow for more frequent scheduling and changes in schedules across ties.[48] This, in turn, will enable VERs to serve load across balancing area boundaries and also participate in providing reliability products and services—which will ultimately reduce costs and result in more just and reasonable rates.

Frequent scheduling produces multiple benefits, including more targeted commitment and operation of resources, reducing unnecessary costs and reliance on emissions-generating resources and improving grid reliability.[49] As a corollary benefit, frequent scheduling can contribute accurate economic signals, thus enabling development of quick responding ancillary products and services for more efficient, cost effective, reliable and environmentally-compatible grid operation.

3. Scheduling Incentives

a. Exemption from Third Tier Penalties

Exemption from third tier penalty imbalances has generally worked well to recognize the operational limits of VERs. As the Commission recognizes,

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[47] *NREL Integration Report: Draft Executive Summary*, *supra* note 7, at 14 (finding that sub-hourly schedule procedure is required to successfully operate system at high penetration levels of renewables).

[48] *See* discussion *infra* at Part C (re: balancing authority).

[49] *NREL Integration Report: Draft Executive Summary*, *supra* note 7, at 14-15.

variable generators cannot always accurately follow their schedules, so high penalties will not lessen the incentive to deviate from their schedules.[50]

While a continued exemption from penalties remains important, exemptions should be coupled with incentives to encourage all generation sources to operate more reliably and cost-effectively. Incentives are important because they encourage proactive behavior. For example, the CAISO PIRP addresses imbalance charges while offering proper incentives for developing accurate forecasts. The CAISO PIRP program addresses this issue by removing punitive imbalance charges in exchange for turning over the forecasting (and data necessary for such forecasting) to an independent party selected by the Balancing Authority. This has been sufficient incentive for wind energy in California, as evidenced by the high participation rate. [51]

The Commission should review models similar to CAISO's PIRP. In addition, the Commission should also seek input on appropriate incentives to encourage load serving entities (LSEs) to develop products and services to respond to operational limitations at reasonable cost. Finally, the Commission should continue to evaluate the ability of smart grid and demand response to play a role in scheduling.

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[50] NOI at P 7.

[51] PIRP Initiative, http://www.caiso.com/1817/181783ae9a90.html (compilation of documents and stakeholder filings on CAISO's PIRP initiative).

b. Existing incentives to encourage VERs to submit accurate schedules and penalties for non-compliance

VERs should not be treated the same as conventional resources with respect to deviations from their production schedules. To do so is unduly discriminatory because most VERs cannot control their output. For that reason, the Commission recognizes that exempting VERs from imbalance penalties is appropriate.[52] At the same time, VERs should be required to operate in accordance with schedules to the extent that weather and conditions permit.

C. Balancing Authority Coordination

1. Need to encourage balancing area coordination

The Commission correctly recognizes that smaller balancing areas may not adequately capture benefits associated with VERs that are spread across a large geographic area, and seeks input on whether increased balancing authority coordination can reduce overall costs.[53] Multiple studies identify either larger balancing areas or coordination between balancing areas as critical to increasing absorption of renewables into the grid.[54]

Statistically, control area cooperation will ensure that no single area has sole responsibility to balance the variability when energy is supplied to other areas.[55] When operated individually, the carrying capacity of smaller BAs could have higher integration costs, since they would be less able to balance varying

[52] Order No. 890, *supra* note 5, at P 64-65.

[53] NOI at P 21.

[54] *NREL Integration Report: Draft Executive Summary*, *supra* note 7, at 8; *see also NERC Report*, *supra* note 7, Executive Summary at iv.

[55] *NREL Integration Report: Draft Executive Summary*, *supra* note 7, at 11.

output from varying technologies and locations, and since each installation (and its variance) would represent a larger percentage of total generation. For that reason, SEIA supports Commission efforts or incentives to encourage the consolidation or coordination of balancing areas. Consolidation of balancing areas can be time-consuming and controversial, so Commission leadership in ensuring coordination is critical. Below, we propose certain tools to facilitate coordination.

2. Tools to facilitate balancing authority coordination

Initially, coordination and support (including deployment of dynamic transfers [both dynamic scheduling and pseudo-ties]; sharing of meteorological data; aggregated unit modeling; and more frequent scheduling intervals across ties) will be helpful to improve coordination between balancing authorities. A virtual balancing authority might help simulate the benefits of balancing authority consolidation, but, like consolidation of balancing areas, could be a costly, protracted process.

Development of coordinating functions among balancing authorities within existing regions is preferred to an approach that employs virtual or consolidated balancing authorities. Indeed, some balacing authorities entities are already cooperating through coordinating agreements for purposes such as sharing reserves.[56]

For the longer term, the Commission should consider specific policies to support the creation of a large area VER balancing authority. Such a balancing

[56] *See e.g., Midwest ISO*, Order Approving Coordinating Agreement, 129 FERC ¶ 61,282 (2009)(approving coordination agreement between Midwest ISO and Manitoba Hydro to share contingency reserves).

authority would allow for better realization of diversity and would also open up areas to VERs development that are currently limited due to lack of sufficient balancing resources. Additionally, a large area VER balancing authority could facilitate the market for balancing reserves from either conventional resources or energy to manage variability.

D. Reserve Products and Ancillary Services

1. Reserve Products

Reserve products provide system operators with a means to maintain reliability during the VER ramping period and develop desirable fast-acting reserve products. Products such as energy storage or smart grid solutions may provide effective services to improve reliability while reducing emissions and improving efficiency. As mentioned earlier, in other dockets, the Commission is already implementing policies that provide incentives for investment in battery storage.[57] The Commission should implement policies to encourage development of a wide and varied array of reliability products and services that will eventually eliminate the need for special treatment of VERs and avoid the continued need for reliance on emissions-producing generation as a source of reserves.

To ensure that incentives for reliability and reserves products are not duplicative, as a first step, the Commission should (either on its own or through work with System Operators or the Department of Energy) inventory the

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[57] *Western Grid Development*, *supra* note 6, at 61,056 (approving rate incentives for battery storage devices intended to improve operation and reliability of CAISO).

current suite of reliability products and services inherent in the existing infrastructure. The Commission should fully assess the products and services the grid currently relies upon, as well as those it will need as VERs penetration increases. The Commission should also determine the optimal means of acquiring the required products and services. The VERs that can economically provide the products and services should be given incentive to do so—and those conventional systems should as well, to avoid undue discrimination and assure support of those VERs that cannot provide those products and services.

a. Ability of existing reserve products to provide System Operators with cost-effective means to maintain reliability during VER ramping and need for additional tools

It is difficult to assess the adequacy of existing reserve products because: (1) the full suite of existing reserve products has not been inventoried; and (2) the extent of need for such products has not been identified. Nevertheless, development of fast-acting reserve products is desirable. This is because fast-acting reserves (*i.e.*, energy storage used for frequency regulation) have been shown to provide more effective regulation services for a given nameplate capacity and significantly reduce the emissions associated with frequency regulation relative to cases where this service is provided.

Without clear knowledge of either the baseline or the target, or extensive analysis of the nature of the products and services that high penetration of VERs will need, just, reasonable and non-discriminatory policies cannot be developed. The Commission must explore the nature and extent of specific ancillary

products and services and the extent to which the existing infrastructure provides those products and services.

b. To what extent are VERs capable of providing reserve services and should they be expected to do so?

Solar generators are capable of providing reserves and other ancillary services in several ways. For example, a solar plant might hold back a portion of the project capacity by "spilling" sunlight or add facilities such as storage. In addition, solar generators might provide regulation down services if compensated for lost energy. Adding storage at the power plant level rather than the system level is another potential service. However, because VERs are characterized by relatively high capital cost and very low marginal operating costs, it is unlikely to be the most cost-effective way to provide reserves.

PV generation is inverter-based, so fast regulation capabilities can be implemented if there are adequate communication and control capabilities at the inverter and plant level. While to date such capabilities have not been implemented at scale, pilot projects indicate that this is technically feasible. The primary issue is economic. The marginal cost of energy produced by PV plants, as compared to the marginal cost of energy produced by conventional generation, is extremely low. Because the opportunity cost to provide these services (which would require curtailing output) is therefore high, the incentive for VERs to participate also must be high.

c. Should all resources and VERs be required to provide Frequency Response?

VERs should not be required to provide frequency response unless a comparable requirement is imposed on all other generation sources. Although VERs technically have or may develop the ability to provide frequency response, there are more efficient alternatives to maintaining grid reliability or avoiding system disturbances. Before looking to utility-scale solar projects to respond to low-frequency events, it may be more cost-effective to look at distributed generation projects. The ability of those systems to ride through events would provide additional resiliency as an equipment fix without requiring spilled sunlight or wind.

2. The Commission should consider extending the provisions of Order No. 661 to solar technologies.

The NOI seeks comments on whether the Commission should extend the provisions of Order No. 661 to VERs other than wind. SEIA supports the expansion of Order No. 661, as discussed below.

By way of background, Order No. 661 exempts large wind facilities of 20 MW or more from demonstrating low voltage ride-through or reactive power capability unless the Transmission Provider shows, through preparation of a system impact study, that these capabilities are needed to protect system reliability.[58] The Commission determined that Order No. 661's interconnection standards were necessary to guard against undue discrimination in light of wind's unique characteristics, including the fact that wind facilities use induction

[58] Order No. 661, *Interconnection for Wind Energy*, FERC Stats. & Regs. ¶ 31,186, *order on reh'g.*, Order No. 661-A, FERC Stats & Regs. ¶ 31,198 (2005).

generators consisting of several or numerous small generators connected to a collector system and do not respond to grid disturbances in the same way as large conventional generators. The Commission declined to extend Order No. 661 to any technologies except large scale wind based upon its finding that these unique characteristics were not present in other alternative technologies, including solar.[59] However, the Commission stated that it would consider applying Order No. 661 to non-wind technologies, either generically or on a case- by-case basis in the future.

In the recent *Nevada Power*[60] decision, the Commission did just that. There, El Dorado sought to interconnect its 48 megawatt photovoltaic solar generating facility with Nevada Power. Nevada Power's interconnection rules require all generators seeking to interconnect to be capable of providing reactive power; El Dorado could not. Instead, invoking Order No. 661, El Dorado argued that Nevada Power could not mandate reactive power capabilities unless it could show that lack of reactive power would degrade system reliability. Nevada Power responded that Order No. 661's exemptions apply only to wind, not solar.

The Commission disagreed, finding that imposing a reactive power requirement on El Dorado would impose large costs, while serving little purpose, since the facility's co-location with a combined cycle generating facility reduced the importance of its ability to supply reactive power. Thus, the Commission applied the approach in Order No. 661 and directed Nevada Power to demonstrate that El Dorado's inability to provide reactive power would

[59] Tucson Electric argued for the inclusion of solar generators without fueled back up within the scope of Order No. 661. *Id*.

[60] 130 FERC ¶ 61,147 (2010).

impair system reliability. However, the Commission emphasized that its action was case-specific and that system-wide review of the applicability of Order No. 661 would take place in this proceeding.

SEIA supports the expansion of Order No. 661 to solar facilities. As the *Nevada Power* case bears out, the equipment to supply reactive power creates an added capital cost which may not even be necessary for overall system reliability. These added costs may lead to rates that are unjust and unreasonable and unduly discriminatory.

In addition, when assessing system impacts of solar facilities that lack reactive power capabilities, the transmission owner might also assess diversity of resources. Solar and wind converters could potentially provide reactive power support when the plant is not producing power. If a diversity of supply (and non-coincidence of various resources) is reviewed, the transmission owner may find that sufficient reactive power supply is available.

F. Capacity Markets

The Commission explained that typically, VERs are eligible to receive compensation for capacity services in most RTOs/ISOs. However, due to their operating characteristics and capacity rating rules, which vary among these systems, VERs are eligible to offer only a portion of nameplate capacity. Because the price paid for capacity services depends on the amount of available capacity, the Commission seeks to explore whether existing rules governing capacity result in rates that are unjust and unreasonable or unduly discriminatory.

SEIA supports the Commission's inquiry on existing rules governing capacity. Capacity ratings are not keeping pace with the change in energy

infrastructure and serve neither reliability nor least-cost purposes well. Depending on the counting and penalty rules, capacity rules may be discriminatory and give rise to unjust and unreasonable rates since, under existing practices, the valuable capacity that VERs do provide in aggregate may be improperly discounted, to the detriment of ratepayers.

As part of the Commission's work to recognize the contribution that VERs make to electric systems and markets, the Commission should ensure that VERs have an opportunity to participate in the recently developed capacity markets (i.e, the Reliability Pricing Model market in PJM and the Forward Capacity Market in the New England ISO). Solar capacity, with its peak production during peak electric demand times (e.g., during hot, sunny summer months) should be recognized as a capacity resource with a potentially important contribution to system reliability and least cost operation. Just as the owners of traditional fuel source electric capacity have argued for the need for price signals to incent investment in new capacity, VERs should receive similar incentives. In addition to generation, demand side resources are compensated for capacity; similar opportunities should exist for VERs.[61]

A second issue that arises with regard to solar capacity is how to rate or measure and credit solar capacity. Solar capacity ratings are not keeping pace with the change in energy infrastructure and serve neither reliability nor least-cost purposes well. Depending on the counting and penalty rules, capacity rules may be discriminatory and give rise to unjust and unreasonable rates since,

[61] *See, e.g.*, *Devon Power LLC*, 115 FERC ¶ 61,340, at P22, *order on reh'g*, 117 FERC ¶ 61,133 (2009)(approving a settlement in ISO-NE in which demand resources can compete with supply-side resources for capacity payments).

under existing practices, the valuable capacity that VERs do provide in aggregate may be improperly discounted, Discouting solar resources availability is a detriment to ratepayers because solar, with zero fuel cost, can help reduce peak demands and avoid the need to dispatch other, more expensive generation.

G. Real Time Adjustment

The Commission seeks input on whether VERs are curtailed too frequently because of lack of clarity on curtailment, as well as whether VERs have the ability to respond to dispatch instructions.

Although VERs can be designed to respond to dispatch instructions, there is no economic incentive to do so. If incentives are in place to compensate for lost energy, solar generators can respond. Likewise, putting in place market mechanisms or incentives for solar plants with storage to respond to dispatch could help achieve multiple objectives: these plants use the same storage systems to mitigate variability, provide ancillary services and provide a higher capacity factor. However, dispatchability varies tremendously from technology to technology. Again, the lack of clear market signals and incentives needed to ensure that those technologies that can be dispatched are implemented and operated in a way that allows dispatch, and that design of other technologies is advanced to allow dispatch, is a substantial problem. Greater examination of and support for the benefits of storage and augmentation, to both grid reliability and the societal goals behind VERs, is required before VERs can be deployed.

IV. Conclusion

Solar generation, both utility-scale solar power plants and distributed generation, is increasing rapidly, but policies such as expanded transmission,

reasonable interconnection policies, and opportunities to fully participate in competitive markets are critical to ensure the continued vitality of the solar industry, as well as other VER generation. This NOI represents a critical piece of a broader, national policy to foster a robust renewables industry within the United States. Moreover, VER integration, if properly designed, can improve the operational efficiency and reliability of the nation's electric grid. SEIA supports the Commission's efforts and stands ready to play an active role in the development of a least-cost, least-emissions VER integration policy.

Respectfully submitted,

_____/s/ Katherine Gensler_____

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CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person designated on the official service list compiled by the Secretary in this proceeding.

Dated at Washington, DC this April 12, 2010.

_____/s/ Carolyn Elefant_____