PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

AGENDA ID# 16392

ENERGY DIVISION **RESOLUTION E-4920**

April 26, 2018

R E S O L U T I O N

Resolution E-4920. Approval, with Modifications, of Request for Modifications to Electric Rule 21 Tariff to Incorporate Smart Inverter Reactive Power Priority Setting.

PROPOSED OUTCOME:

- Approves, with modifications, Pacific Gas and Electric, Southern California Edison, and San Diego Gas & Electric's proposed revisions to the Electric Rule 21 Tariff incorporating the reactive power priority setting for smart inverters.

SAFETY CONSIDERATIONS:

- Implementation of the reactive power priority setting for smart inverters will improve the effectiveness of smart inverters in maintaining the safety and reliability of the distribution grid.

ESTIMATED COST:

- This Resolution is expected to reduce ratepayer costs associated with interconnecting distributed energy resources under the Electric Rule 21 Tariff by minimizing the impact of the resources on the distribution system and reducing the need for distribution upgrades to resolve the impact.

By Advice Letters (ALs) 5210-E (Pacific Gas and Electric) and 3723-E (Southern California Edison), Filed on December 29, 2017, and 3169-E (San Diego Gas & Electric), Filed on December 28, 2017, hereafter collectively the Advice Letters or ALs.

SUMMARY

Pacific Gas and Electric (PG&E), Southern California Edison (SCE), and San Diego Gas & Electric (SDG&E) request approval of modifications to Electric Rule 21 Tariff (Rule 21) that incorporate the activation of the reactive power priority setting for smart inverters. Reactive power priority is a setting for the Volt Var function, which acts to maintain voltage within acceptable limits.[1] The request is pursuant to Decision (D.) 14-12-035,[2] which directed the investor-owned utilities (IOUs) to investigate the detailed specifications of the Volt Var function and make a proposal. This Resolution approves the Rule 21 revision to incorporate the reactive power priority setting.

BACKGROUND

The Commission initiated Rulemaking (R.) 11-09-011 on September 22, 2011 to review and, if necessary, revise the rules and regulations governing the interconnection of generation and storage facilities to the electric distribution systems of the investor-owned utilities. The IOUs' rules and regulations pertaining to the interconnection of generating facilities are set forth in the Electric Rule 21 Tariff. Generating resources interconnecting to the utility grid via Rule 21 which produce direct current (DC) power require an inverter to convert the DC from the generating resource to the voltage and frequency of the alternating current (AC) distribution system.

In early 2013, the Smart Inverter Working Group (SIWG) was formed by parties of R.11-09-011 to develop proposals to take advantage of the new, rapidly advancing technical capabilities of inverters. The Volt Var function, which varies reactive power to counteract voltage deviations, was developed as part of the

1. Customer service voltages are designated in each utility's Electric Rule 2 Tariff.

2. Interim Decision Adopting Revisions to Electric Tariff Rule 21 for Pacific Gas and Electric Company, Southern California Edison Company, and San Diego Gas & Electric Company to Require "Smart" Inverters. December 18, 2014.

Phase 1 autonomous functions and is already fully operational in new inverters that interconnect to the grid.[3] The SIWG Phase 1 recommendations for updating technical requirements for inverters were completed in February 2014 and reached full implementation in September 2017. The SIWG specified that the main purpose of the Volt Var function is to use distributed energy resource (DER)[4] systems to help maintain voltages within their normal ranges and that the function can be particularly important for DER systems that may impact the normal voltage range on a feeder. The SIWG report recommended the function use "available vars" (reactive power) – "available vars" was defined as the "consumption or production of reactive power that does not affect the real power output."[5] Reactive power is only relevant in AC circuits and is an effect caused by the electromagnetic properties of some devices where energy is stored and released but does not result in a net transfer of energy to a load. Reactive power can have a significant impact on voltage.

The Volt Var function varies reactive power to counteract voltage deviations. Specifically, in response to an increase in local voltage, the smart inverter will absorb reactive power, and in response to a decrease in local voltage, the smart inverter will inject reactive power. By acting in this manner, the voltage is kept within acceptable limits. An inverter can provide reactive power by utilizing available capacity or by decreasing real power production once the capacity of the inverter has been reached. The Volt Var function may have a significant positive impact on mitigating DER grid integration costs. Power priority is a fundamental component in the effectiveness of the function. Real power priority and reactive power priority are characterized as follows:

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3. Autonomous functions refer to inverter functionalities which do not require communications and can be turned on and utilized without input from the utility or customer.

4. DERs refer to distributed generation resources, energy efficiency, energy storage, electric vehicles, and demand response technologies.

5. Recommendations for Updating the Technical Requirements for Inverters in Distributed Energy Resources by the Smart Inverter Working Group. Filed February 7, 2014.

In situations where an inverter must make a choice between providing solely real power and reducing some real power to provide/consume reactive power,

- Inverters set to real power priority provide solely real power, and
- Inverters set to reactive power priority reduce some real power to absorb/reject reactive power.

Power priority is only applicable when reactive power is needed due to a voltage deviation and the inverter is operating at its full capacity. By increasing the capacity of the inverter, a DER customer may avoid situations where power priority is applicable.

On December 18, 2014, the Commission issued D.14-12-035, which ordered the IOUs to submit Rule 21 Tariff revisions incorporating the SIWG Phase 1 recommendations through advice letter filings on January 20, 2015. The proposed revisions were subsequently approved by the Commission. The term used in each of the IOU's Rule 21 Tariff was "available reactive power" without a definition. "Available reactive power" is analogous to real power priority.

D.14-12-035 also established a mandatory implementation date of smart inverters to be the later of December 31, 2015 or 12 months after the date Underwriters Laboratories (UL) approves the applicable standard, UL 1741 Supplemental A (SA).[6] UL 1741 SA was approved on September 8, 2016 and the mandatory date consequently became September 8, 2017. After that date, all new interconnections under Rule 21 have required a Phase 1 compliant smart inverter, which includes the Volt Var function with a default setting of "available reactive power," or real power priority. Since UL 1741 SA has been available, stakeholders have been able to certify their equipment to real power priority, reactive power priority, or both.

D.14-12-035 acknowledged the capability of smart inverters to detect voltage and to react autonomously to mitigate abnormal conditions. D.14-12-035 also recognized that if properly applied, smart inverters can improve the

6. D.14-12-035, Ordering Paragraph (OP) 4.

performance of the distribution grid and the network as a whole, or conversely, if improperly applied, can present serious problems in terms of voltage control. Consequently, the Commission requested that the IOUs investigate the detailed specifications of the Volt Var function and make a proposal one year after the adoption of the revised Electric Rule 21 Tariffs as to the details of the function based on additional information and experienced gained.[7]

On July 27, 2017, the Energy Division (ED) issued a draft report for stakeholder comment entitled *Residential Zero Net Energy Building Integration Cost Analysis*.[8] On October 18, 2017, the aforementioned report was finalized and published to the Commission website after incorporating stakeholder feedback. On February 1, 2018, the report *Residential Zero Net Energy Building Integration Cost Analysis* was submitted to the California Legislature in compliance with Public Utilities (P.U.) Code § 913.6.[9]
The purpose of this study was to help the Commission better understand the grid integration costs[10] associated with higher penetrations of solar photovoltaic (PV) systems. ED examined the PV distribution grid integration costs of a residential Zero Net Energy (ZNE) policy of 100% ZNE by 2020 compared to the residential PV trajectory scenario. The study covers the period from 2016—2025 and was conducted for two primary objectives:

1. To inform CPUC and the California Energy Commission (CEC) policy makers on grid integration costs of achieving the two Commission's goal

7. *Id.* OP 5.

8. The report was authored by ED contractor DNV GL.

9. Assembly Bill (AB) 578 (Blakeslee, 2008) requires the California Public Utilities Commission (CPUC) to submit a biennial report to the Legislature on "the impacts of distributed energy generation on the state's distribution and transmission grid" including reliability issues related to connecting distributed energy generation to the local distribution networks.

10. For this study, grid integration costs refer to the distribution interconnection and upgrade costs associated with interconnecting PV.

for all residential new construction to be built to a ZNE standard by 2020;[11] and

2. To inform the CPUC on the grid integration costs of continuing the current Net Energy Metering (NEM) policy in which grid upgrade costs of NEM systems under 1 MW are paid for by all ratepayers.

One of the study's findings is that changing smart inverters' Volt Var setting from the current setting of "real power priority" to "reactive power priority" would reduce the high cost case[12] significantly – saving ratepayers $1.435 billion over the study period – an over 60% reduction in potential grid integration costs for integrating high penetrations of PV in all three IOUs' territories.

In light of the lessons learned via the SIWG and above mentioned study, on July 27, 2017, ED issued a Staff Proposal to modify existing Rule 21 tariff language to incorporate reactive power priority and solicited informal stakeholder feedback. Nine sets of comments were received and posted to the Commission's Smart Inverter Working Group webpage.[13]
In response to the Staff Proposal, on December 28 (SDG&E) and 29 (SCE and PG&E), 2017, the IOUs filed the Tier 2 Advice Letters proposing Rule 21 tariff revisions which incorporate the requirement that smart inverters must have the reactive power priority setting as a default setting for their Volt Var functionality. The ALs proposed that the new default setting will become mandatory after ninety days (SCE) or three months (SDG&E and PG&E) following the approval of the Advice Letters.

11. The residential ZNE goal was set forth by the Commission in the California Long-term Energy Efficiency Strategic Plan, and adopted in D.07-10-032.

12. The high cost case assumed that the ZNE residential PV would be lumped together at the end of feeders and is the worst case scenario.

13. http://www.cpuc.ca.gov/general.aspx?id=4154

NOTICE

Notice of ALs 5210-E, 3723-E, and 3169-E was made by publication in the Commission's Daily Calendar. PG&E, SCE, and SDG&E state that copies of the Advice Letters were mailed and distributed in accordance with Section 4 of General Order 96-B. The ALs were served to Service List R.11-09-011.

PROTESTS

The Advice Letters were timely protested by four parties on January 17, 2018: the Solar Energy Industries Association (SEIA), the California Solar Energy Industries Association (CALSEIA), Sunrun, and the Interstate Renewable Energy Council (IREC).

The protests fell into three general categories and are grouped as such in the following sections.

I.A. Stakeholders Claim that the Advice Letters Are Not Pursuant to Any Commission Order and Are Inappropriately Filed.
CALSEIA and Sunrun contend that the Advice Letters do not directly implement any Commission order and the Smart Inverter Working Group specifically recommended the function be based on available reactive power. Sunrun also contends that the request is unjust and unreasonable and is inappropriate for the advice letter process. Sunrun claims that the IOUs and the Energy Division conducted meetings without members of the inverter or DER industry and agreed to transition to reactive power priority despite stakeholders' concerns regarding the effects of reactive power priority. Sunrun asserts that the Energy Division's disposition of the Advice Letters would be inappropriate and the Advice Letters should be considered by the full Commission via a Tier 3 Advice Letter Filing.

I.B. Stakeholders Have Concerns about Differences Between the Current Electric Rule 21 Tariff and the International Standard, the Certification and Verification Process, and Timing.
Several parties (CALSEIA, SEIA, Sunrun) note variances in the current Rule 21 tariff language from the international standard, Institute of Electrical and Electronics Engineers (IEEE) 1547, and recommend either adoption of IEEE 1547 or an equivalent standard. Particularly, the parties are concerned that the power

factor[14] for systems greater than 15 kW requires power factor capabilities of +/- 0.85 when the update for IEEE has a power factor range of +/- 0.9.

SEIA has concerns about how manufacturers will to meet the new requirement considering that manufacturers would still be certifying using UL 1741 SA. UL 1741 SA allowed for manufacturers to certify to real power priority only, reactive power priority only, or both, and no process has been created to verify that manufacturers have certified to reactive power priority.

Similarly, SEIA and CALSEIA state that sufficient time must be afforded for stakeholders to meet the requirement before it goes into effect. SEIA recommends at least six months from the approval of the advice letters. CALSEIA recommends one year after the IEEE 1547 update is finalized, which is expected early 2018.

I.C. Stakeholders Assert That There Will Be Impacts to DER Customers and These Customers Should Be Compensated for the Impacts.
All four parties (CALSEIA, SEIA, Sunrun, IREC) refer to their comments to Resolution E-4898 and state that the Volt Var function and Function 6, Volt Watt Mode,[15] from the Phase 3 set of functions should be considered together.

- The parties are foremost concerned about the extent that customers would lose in real power production and the corresponding financial ramifications. CALSEIA, Sunrun, and IREC argue that the extent of curtailed production must be analyzed before the default setting is changed. IREC claims that project financing will be affected. CALSEIA and

14. Power factor is defined as the ratio of the real power to the apparent power in AC electrical power systems. Apparent power is the combination of reactive power and real power (though not directly additive). A power factor of one means that there is only real power. A power factor less than one means there is real power and reactive power.

15. Volt Watt Mode modifies real power from DERs based on predetermined voltage ranges to prevent the local voltage from rising or dropping outside of allowable levels.

Sunrun state that to design an inverter to not limit power production while providing reactive power support, a customer would have to increase the inverter size, incurring costs, or reduce the size of system.

- Stakeholders claim they should be compensated before approval of the transition. IREC suggests tariffs for grid services or reimbursements for energy production losses that exceed an established "reasonable limit." CALSEIA recommends the Commission renew the scope of Rulemaking (R.) 14-10-003[16] to begin debate of market mechanisms to enable grid services.
- Sunrun proposes a pilot to study the effects of reactive power priority, the Volt Watt Mode function, and the Frequency Watt Mode function,[17] which is part of the Phase 3 functions and are currently pending Commission approval in separate advice letters.[18] Sunrun claims that the pilot would determine what is most effective at resolving grid issues while protecting customers that have invested in a DER. Sunrun also recommends that if the Commission does not reject the advice letters, it should exempt small systems (less than 10 kW) and non-exporting systems until the effects of the functions are better understood.

REPLIES TO PROTESTS

SDG&E responded to the protests on January 24, 2018. PG&E and SCE responded to the protests on January 25, 2018.

II.A. The IOUs Respond that Discussions of Parties' Positions Were Held in an Open Forum and the Advice Letter Process Is the Means for Seeking Commission Approval.

16. Order Instituting Rulemaking to Create a Consistent Regulatory Framework for the Guidance, Planning and Evaluation of Integrated Distributed Energy Resources.

17. Frequency Watt Mode is a method for countering high frequency and low frequency events, which is accomplished by reducing power in response to rising frequency or vice versa.

18. PG&E AL 5129-E, SCE AL 3647-E, and SDG&E AL 3106-E.

All three IOUs state that discussions regarding the various parties' positions were held in an open, public forum through the Smart Inverter Working Group and public workshops. The IOUs strongly object to Sunrun's assertion that this Advice Letter process reflects a "closed-door discussions" between IOUs and Energy Division staff. The IOUs referred to the Staff Proposal issued by the Energy Division and the publicly posted informal comments on the Commission website that were received based on the proposal. The IOUs state that the SIWG has publicly discussed the reactive power priority setting for the Volt Var function in smart inverters for years.

SCE states that the Advice Letters are pursuant to D.14-12-035. SDG&E and PG&E assert that the advice letter process is the means by which a utility formally seeks Commission approval of modifications to tariffs. PG&E further elaborated that the IOUs regularly use the advice letter process to seek Commission approval for revisions to improve and clarify its existing tariffs, that the CPUC has broad authority to review and approve advice letters even when there is stakeholder disagreement and protests, and that granting approval only with consensus is a narrow view of the advice letter process and not mandatory.

II.B. The IOUs Assert that Reactive Power Priority Is in the Recently Updated International Standard and Stakeholders Can Certify Today with Existing Standards.

In response to stakeholders' opposition for modifying to reactive power priority, all three IOUs contend that the recently updated IEEE 1547 has reactive power priority and the modification to reactive power priority should be made. SCE also alleges that stakeholders are being contradictory to their positions in other proceedings. Specifically, SCE states that IREC and CALSEIA were in full support of using reactive power priority in the Distribution Resources Planning (DRP) proceeding on the development of the Integration Capacity Analysis (ICA) tool methodology. The ICA tool will determine the available hosting capacity of every circuit in the IOUs' service territories to accommodate DERs and includes the examination of voltage complications. SCE claims that if reactive power priority is not incorporated into Rule 21, then the methodology for the ICA tool will also need to be modified.

With respect to stakeholders' assertions on power factor, SCE claims that stakeholders are incorrect because the default setting in Rule 21 is +/- 0.95 power factor. The three IOUs are all open to aligning the power factor to IEEE 1547. However, SCE and PG&E note that such a proposal is out of scope of these Advice Letters and should be addressed separately. SDG&E also contends that the proposed alignment on power factor is potentially more stringent than currently in Rule 21, i.e. the Rule 21 setting of +/- 0.95 power factor is less severe than the IEEE 1547 setting of +/- 0.9 power factor.

Finally, SCE notes that the UL 1741 SA standard already allows for stakeholders to certify inverters with reactive power priority. SDG&E does agree with stakeholders that clarifications will need to be made regarding the certification process for smart inverters meeting requirements under Rule 21.

II.C. The IOUs Contend that Reactive Power Priority Is for Resolving Issues Caused by DERs Themselves, Assert DER Customers Should Not Be Compensated, and Recommend Approval of Modification to Reactive Power Priority.

The three IOUs all state that reactive power priority is for addressing issues caused by the DERs themselves and DERs should be responsible to mitigate voltage issues they created due to their injection of real power into the grid. PG&E claims that the problems identified by Sunrun stem from improper sizing of PV systems relative to load and undersized inverter output conductors. SCE refutes Sunrun's claim that some systems should be exempted and states that in aggregate, small DER systems interconnected to the distribution system have an impact on the distribution grid and other customers. SDG&E refers to a pilot which identified that DERs increased a circuit's secondary voltage on average by 1.3 V. SDG&E asserts that higher voltage levels cause non-DER owning customers to see their energy consumption increase. In addition, SCE proclaims that it is inappropriate to assume future changes to customer energy consumption from time-of-use signals will prevent or mitigate distribution system overvoltage conditions caused by DERs. SCE also contends CALSEIA's claim that the Volt Var function with active power[19] priority will address voltage

19. Active power and real power are equivalent.

issues caused by DERs. SCE claims that inverters set to active power priority will not be capable of providing the reactive power to compensate for the negative overvoltage and this inability is further amplified by the fact that customers often oversize their PV system in comparison to their inverter.[20]

In response to impacts to DER customers, SDG&E contends that the amount of reduced real power output should be *de minimis*. PG&E states that system voltage is normally within 99% of American National Standards Institute (ANSI) C 84.1 requirements (0.95% to 1.05% nominal voltage) and therefore, the probability that inverters would be impacted by curtailment is extremely small. PG&E claims that deferring will only worsen the condition of DERs now and going forward. PG&E also asserts that the curtailment risk can be mitigated if the inverter is sized to be able to operate at 0.95 power factor or by designing larger facility conductors to reduce voltage rise created by reverse active power flow from generating facilities to the grid. In addition, PG&E contends that reactive power priority will result in a streamlined interconnection process of DER customers.

In replies, the IOUs continue to support moving forward with modifying to reactive power priority. SDG&E recommends proceeding with the implementation without compensation. SCE finds Sunrun's proposed pilot to be impractical and unnecessary. SDG&E and SCE both are amenable to utilizing SEIA's proposed six-month timeline to allow sufficient time to certify smart inverters.

20. SCE is referring to the size of the DC output of the PV system that is an input to the inverter versus the size of the AC output that the inverter sends to the grid. By sizing their PV system larger, DER customers reach the maximum AC output of the inverter more often. These situations are where power priority is required. DER customers make these choices based on the economics of the various combinations.

DISCUSSION

III.A. The Advice Letters Are a Continuation of Decision 14-12-035 and Discussions with the Energy Division Are an Ordinary Part of the Advice Letter Process.

We agree with the IOUs' statement that the stakeholders had the opportunity to comment through an open process. Energy Division Staff released a Staff Proposal on transitioning to reactive power priority setting on July 27, 2017 and the informal comments received on the proposal have been posted on the Commission website since August 2017. In the ED Staff Proposal, Energy Division referenced D.14-12-035. In D.14-12-035, we ordered the IOUs to investigate the detailed specifications of the Volt Var function and make a proposal one year after the adoption of the revised Electric Rule 21 Tariff. Energy Division offered the Staff Proposal in lieu of waiting for the timeline of the IOU proposal based on learnings to date. We concur that if there are worthwhile learnings available now, there is no need to further delay a decision on this matter.

The Commission has the broad authority to make determinations on proposed revisions that improve and clarify existing tariffs, with or without consensus from stakeholders. We reject the argument of some parties who argue that approval of the reactive power priority setting should only move forward via a consensus mechanism and that the Advice Letter process should not be utilized to seek approval. This is an overly narrow view of the advice letter process. Rule 21 is a CPUC approved tariff designed to maintain the electric system for all customers. It is desirable but not mandatory for all stakeholders to agree on every item. While many items are successfully addressed on a consensus basis, not all issues can be determined by a consensus of the stakeholders active in the Rule 21 proceeding. The Advice Letter process allows for public review and comment by stakeholders of proposals like this one that require the balancing of various interests. The CPUC has broad authority to review and approve advice letters even when there is stakeholder disagreement and protests.

III.B. The International Standard Has Reactive Power Priority and Additional Revisions to Modify the Volt Var Function Settings Can Be Filed at Any Time.

We find the stakeholders' opposition to modifying to reactive power priority to be inconsistent. The updated international standard IEEE 1547, whose working groups include many of the protesting parties' constituents, has reactive power priority, as the IOUs have indicated.

We acknowledge that there is a difference between the capability requirements and default setting of the Volt Var function in Rule 21 as compared with IEEE 1547. IEEE 1547 has +/- 0.9 power factor for both capability and default setting whereas Rule 21 requires that inverters are capable of +/- 0.85 power factor for systems greater than 15 kW and +/- 0.9 for systems less than or equal to 15 kW and the default setting of Rule 21 is +/- 0.95 power factor. While it appears that it would be beneficial to conform Rule 21 with IEEE 1547, we decline to order it at this time and defer to the utility and SIWG process to continue building consensus on whether further revisions are necessary to the Rule 21 Volt Var power factor settings.

We decline to order a modification to the Advice Letters at this time; however, given the ongoing evolution of these standards, we order the IOUs to monitor the development of national and international standards in this area and update their Rule 21 tariffs at any time and as appropriate to conform Rule 21 with evolving industry standards.

III.C. The IOUs' Proposal to Revise Rule 21 to Incorporate the Reactive Power Priority Setting Is Reasonable and Approved.

In response to the concerns on curtailment impacts, we note that the default setting has a maximum range of +/- 0.95 power factor, meaning that the maximum real power loss at any time is 5%. However, this level of loss is only possible when the inverter is fully loaded during times of peak power production, which are short in duration, and there is a sufficient voltage excursion that requires reactive power from the inverter. During these brief times, all of the reactive power required involves reduction in real power. Therefore, the losses due to the implementation of reactive power priority can be expected to be significantly less than 5% in the majority of cases. Furthermore, stakeholders acknowledge that customers have several options to avoid any real production loss, such as increasing the size of the inverter, increasing self-consumption of PV generation at the time of generation, and adding storage. In

addition, we reject the concerns about project financing since the default setting serves as a reasonable limit on impact.

We do not agree with protests calling for compensation for real power loss. Any real power losses from the proposed Volt Var setting are expected to be de minimis, so compensation for this default setting is not warranted. The Commission will consider the development of compensation mechanisms in R.17-07-007 and can explore whether customized settings could be compensated as grid services.[21] This could include other voluntary Volt Var settings. Thus, the adoption of reactive power priority as a default setting does not eliminate the potential for compensation for other Volt Var settings in the future.

The Volt Var function has the ability to reduce voltage concerns and as the IOUs have indicated, these voltage issues exist due to DERs. Parties themselves acknowledged that voltage must rise to send power onto the distribution grid. The Volt Var function may have a significant positive impact on mitigating DER grid integration costs. Reactive power priority is a fundamental element in the effectiveness of the Volt Var function and smart inverters overall.

The proper activation of the Volt Var function has the potential to save California ratepayers significantly. Under current Rule 21 policy, DER customers under 1 MW do not pay for grid upgrades; these costs are allocated to all ratepayers. As the residential ZNE study[22] indicated, these costs could be over $2 billion over

21. Scoping Ruling of President Picker October 2, 2017 for R.17-07-007 includes in the scope of the Rule 21 Proceeding item 27) What should be the operational requirements of smart inverters? What rules and procedures should the Commission adopt for adjusting smart inverter functions via communication controls?; and item 28) How should the Commission coordinate with the Integrated Distributed Energy Resource proceeding to ensure operational requirements are aligned with any relevant valuation mechanisms?

22. Residential Zero Net Energy Building Integration Cost Analysis by DNV GL. Published October 2017.

the next ten years and smart inverters with reactive power priority could reduce these potential integration costs by over 60%.[23]

The study illustrated that the Volt Var function is not effective and cannot be relied on to maintain voltage without the reactive power priority setting. Specifically, with active power priority, when the DER is at or near maximum real power output and increasing voltage substantially, it will not be able to divert some of the real power production to inject or absorb reactive power in order to lower voltage. D.14-12-035 recognized this in its statement on the ability of smart inverters to improve the performance of the distribution grid or conversely present serious problems if improperly applied. D.14-12-035 intended to accomplish the former situation and enable smart inverters to reduce the impacts of DERs. Thus, we find reactive power priority accomplishes the goals of Decision 14-12-035 and reject the notion that reactive power priority requires additional study.

We are not persuaded for the need to exempt any customers. Doing so would only shift responsibility to any DER customers that are above 10 kW or cause voltage to rise considerably when DER customers on a circuit are all less than 10 kW.

Therefore, we find the IOUs' proposal for incorporating the reactive power priority setting to be reasonable and approved.

With respect to the timeline for implementation, we find that the IOUs' proposal of three months is sufficient for stakeholders. As SCE references, UL 1741 SA is available and many inverter manufacturers have already certified their inverters with the reactive power setting. We acknowledge there may be a need for clarification on verifying that inverters have been certified for reactive power priority and direct the IOUs to discuss with the SIWG in the intervening months before the modification takes effect.

23. From the high cost scenario, smart inverters with reactive power priority reduce grid integration costs between 2016 and 2026 of residential ZNE buildings from $2.35 billion to $915 million saving ratepayers $1.435 billion

III.D. Reactive Power Priority Will Be Part of ICA.

The Integration Capacity Analysis tool developed in the DRP proceeding may assist in identifying likely places where utilization of the Volt Var function may be prevalent. The ICA tool will help DER developers site projects in grid locations that are unlikely to trigger system upgrades including those to resolve voltage issues caused by DERs. The reactive power priority setting of the Volt Var function also serves as a basis for determining hosting capacity and streamlining the Rule 21 interconnection process as SCE referenced. The ICA tool is to be published publicly in the summer of 2018, which is similar to the timeframe of transitioning to reactive power priority.

In the Long Term Refinements Final Report for the ICA, the Working Group came to a conclusion that "it is better to continue to assume reactive power priority because active power priority has fewer benefits for ICA and is not worth incorporating into the ICA methodology if there is a reasonable likelihood that reactive power priority will become the standard in 2018." [24] The ICA WG ultimately concurred that reactive power priority should be incorporated into the ICA tool. Therefore, stakeholders including CALSEIA and IREC were supportive of reactive power priority for inclusion into ICA methodology[25] and SCE is correct to point out that if reactive power priority is not incorporated into Rule 21, then the methodology for ICA will also need to be modified.

COMMENTS

Public Utilities Code section 311(g)(1) provides that this resolution must be served on all parties and subject to at least 30 days public review and comment

24. See R.14-08-013, Integration Capacity Analysis Working Group Long Term Refinements Final Report ("ICA Final Report"), p.21-22. Filed January 8, 2018.

25. The impact of its inclusion as an assumption in the ICA tool is that the assumption of reactive power priority as the default setting for future systems will allow for a greater amount of PV systems to be hosted by the grid than would otherwise be allowed.

prior to a vote of the Commission. Section 311(g)(2) provides that this 30-day period may be reduced or waived upon the stipulation of all parties in the proceeding.

The 30-day comment period for the draft of this resolution was neither waived nor reduced. Accordingly, this draft resolution was mailed to parties for comments, and will be placed on the Commission's agenda no earlier than 30 days from today.

FINDINGS

1. Advice Letter SDG&E 3169-E is pursuant to Decision 14-12-035 and was filed on December 28, 2017.
2. Advice Letters PG&E 5210-E and SCE 3723-E are pursuant to Decision 14-12-035 and were filed on December 29, 2017.
3. It is reasonable for the IOUs to continue discussions with the SIWG on the merits of different capability requirements and default settings.
4. Real power priority limits the effectiveness of the Volt Var function in maintaining voltage within acceptable ranges.
5. Reactive power priority accomplishes the goal of Decision 14-12-035 to enable smart inverters to improve the performance of the distribution grid.
6. The CPUC report *Residential Zero Net Energy Building Integration Cost Analysis* found that changing smart inverters' Volt Var setting from the current setting of "real power priority" to "reactive power priority" would reduce the high cost case significantly – saving ratepayers $1.435 billion over the study period – an over 60% reduction in grid integration costs for all three IOUs.
7. The Volt Var function may have a significant positive impact on mitigating DER grid integration costs. Reactive power priority is a fundamental element in the effectiveness of the Volt Var function and smart inverters overall.
8. UL 1741 SA allows for manufacturers to certify their inverters with the reactive power priority setting.
9. It is reasonable to modify Rule 21 to incorporate reactive power priority.
10. There is no need to exempt customers from being required to use the reactive power priority setting.
11. The methodology for the ICA tool from the DRP proceeding incorporates the reactive power priority setting.

THEREFORE IT IS ORDERED THAT:

1. Advice Letters PG&E 5210-E, SCE 3723-E, and SDG&E 3169-E are approved as proposed.

This Resolution is effective today.

I certify that the foregoing resolution was duly introduced, passed and adopted at a conference of the Public Utilities Commission of the State of California held on April 26, 2018; the following Commissioners voting favorably thereon:

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ALICE STEBBINS
Executive Director