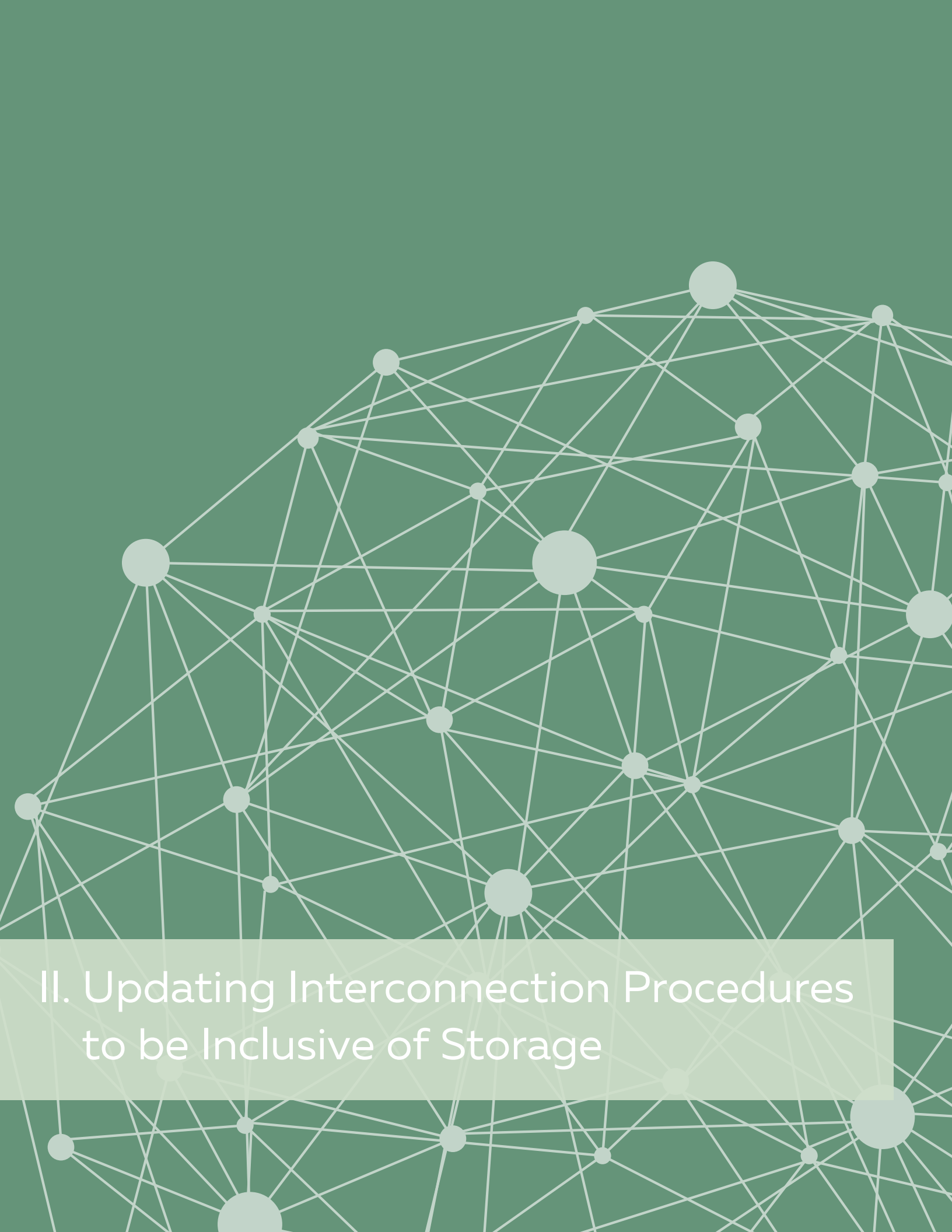

II. Updating Interconnection Procedures to be Inclusive of Storage

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A. Introduction and Problem Statement

Two of the most elementary barriers to energy storage system interconnection are the lack of inclusion of storage in interconnection rules,[23] and the lack of clarity as to whether and how existing interconnection rules (and related documents, such as application forms and agreements) apply to storage systems. In many jurisdictions, energy storage systems are not explicitly included under the definition of eligible facilities. For example, the interconnection rules in Florida, New Hampshire, Ohio, and Washington do not currently include ESS in the definition of eligible facilities.[24] In addition, applicable interconnection rules do not always adequately reflect the operating capabilities of ESS, which may limit the beneficial and flexible services that storage can provide to the grid. These factors can pose a barrier to timely and cost-efficient interconnection and project financing.

Regulatory certainty is critical in the interconnection process. When customers or developers submit interconnection applications, they have likely already expended significant time and resources on project development, including site and customer acquisition. Uncertainty and lack of clarity can lead to greater perceived or actual risk, which can impact a project's ability to secure financing and may lead to more speculative projects that never reach interconnection. Conversely, greater clarity on how interconnection rules apply to storage systems—including the processes, time requirements, and costs involved—can allow developers to build those elements into their project design. This can reduce the additional delays of restudies or disputes in the interconnection process and benefit both utilities and interconnection customers.

While ESS can be, and is, interconnected in jurisdictions that do not explicitly include storage in their interconnection procedures, the lack of storage-specific rules can cause delays or increased expenses throughout the interconnection process, which can increase project soft costs. The lack of storage-specific rules can also reduce the ability of grid operators and storage developers to take advantage of the grid support functionalities inherent to storage. As described above, incorporating storage into interconnection rules provides greater clarity and certainty for customers and developers, utilities, and regulators. Such certainty will help facilitate the financing of projects that include ESS and can enable more cost-effective and efficient operation of ESS and the distribution grid. This is especially true when relevant provisions for import/export controls and other operating capabilities are also included in the interconnection rules.

[23] Jurisdictions use a wide variety of terms to describe the basic rules that govern the interconnection process. They can be called interconnection procedures, standards, rules, tariffs, regulations, or other terms. This document will typically use the terms "interconnection rules" or "procedures" to refer to the documents typically adopted by jurisdictions, similar to the FERC SGIP or California's Rule 21. The term "interconnection standard" will refer to formal standards adopted by bodies such as the Institute of Electrical and Electronics Engineers (IEEE).

[24] FL Admin. Code r. 25-6.065; NH Admin. R. PUC 900; OH Admin. Code 4901:1-22; WA Admin. Code 480-108.

B. Recommendations

As a starting point, jurisdictions should explicitly include and define ESS as an eligible facility under their interconnection rules. In addition, jurisdictions should revise and/or adopt definitions in their interconnection procedures to efficiently and effectively enable ESS deployment. For example, this can include defined terms which, if absent or not drafted to recognize the unique operating characteristics of storage, can result in barriers to efficient ESS interconnection and operation.

The project team has not attempted to completely harmonize the definitions in IEEE 1547-2018 with those found in interconnection procedures that follow the SGIP and IREC 2019 Model structure. While aligning the procedure's definitions with those found in IEEE 1547-2018 would promote standardization, doing so would require structural changes to most parts of the SGIP and IREC 2019 Model. The need for and usage of many of these terms are described in more depth in subsequent chapters.

1. Applicability and Definitions of DER, Generating Facility, and ESS

Interconnection procedures should define the term ESS and clearly state that they apply to the interconnection of new standalone ESS, as well as ESS paired with other generators, *e.g.*, solar photovoltaic (PV) systems. Several jurisdictions have started this process by defining ESS in their procedures.[25] The following definition for ESS uses the structure of the definition of ESS found in interconnection standards and guidelines, including IEEE 1547-2018 and P1547.9. This definition is technology agnostic and should allow for a range of different energy storage types:

> ***Energy Storage System*** *or* ***ESS*** *means a mechanical, electrical, or electrochemical means to store and release electrical energy, and its associated interconnection and control equipment. For the purposes of these Interconnection Procedures, an Energy Storage System can be considered part of a DER or a DER in whole that operates in parallel with the distribution system.*

After defining ESS, interconnection procedures should explicitly allow ESS to interconnect using the procedures. Most interconnection procedures define upfront which systems the rules apply to and are eligible for review, and utilize a defined term to reference those eligible facilities. For example, FERC SGIP uses the term "Small Generating Facility" and the IREC 2019 Model uses the term "Generating Facility." Since the technologies applying for interconnection have evolved, particularly with energy storage and even electric vehicles now applying to interconnect, the term generating facility does not quite capture the scope of projects that may need to apply. Defining a term that includes all of the different types of facilities that can use the procedures is the most straightforward way to

[25] Code MD Regs. 20.50.09.02(B)(14); DCMR § 4099; MN TIIR at 11; NV Pub. Util. Comm., Dkt 17-06014, NV Power Co. Rule 15 § B; NY SIR at 37.

help facilitate ESS interconnection. For example, Minnesota defines the term "Distributed Energy Resource" and allows any DER to use the procedures to interconnect. The term "Facility" could also be used with the same definition proposed for DER below:

> ***Distributed Energy Resource*** *or* ***DER*** *means the equipment used by an interconnection customer to generate and/or store electricity that operates in parallel with the electric distribution system. A DER may include but is not limited to an electric generator and/or Energy Storage System, a prime mover, or combination of technologies with the capability of injecting power and energy into the electric distribution system, which also includes the interconnection equipment required to safely interconnect the facility with the distribution system.*

The applicability section, *e.g.*, section I.A of the IREC 2019 Model, would read:

These Interconnection Procedures are applicable to all state-jurisdictional interconnections of Distributed Energy Resources.

Most interconnection procedures today use the term Generating Facility instead of DER. Another approach to authorizing ESS is to modify the definition of Generating Facility to include ESS, and/or to modify the applicability section of the interconnection procedures to reflect that it includes ESS. While using the term DER is recommended because it is the most straightforward way to explicitly allow ESS to use the procedures, the project team provides the following alternative based on the IREC 2019 Model, which uses Generating Facility:

> ***Generating Facility*** *means the equipment used by an Interconnection Customer to generate, store, manage, interconnect, and monitor electricity. A Generating Facility includes the interconnection equipment required to safely interconnect the facility with the distribution system.*

In this alternative, the applicability section, *e.g.*, section I.A of the IREC 2019 Model, would read:

> *These Interconnection Procedures are applicable to all state-jurisdictional interconnections of Generating Facilities, including Energy Storage Systems.*

If selecting this alternative approach, drafters should ensure that the definition of Generating Facility includes ESS, otherwise in many places throughout the interconnection procedures it will be unclear if the procedures apply to ESS.

2. Definitions of Power Control System and Related Terms

As is discussed further in Chapters III and IV, many ESS systems will be designed to control or manage export. Interconnection procedures thus need to recognize and define both

non-export and limited-export capabilities. Some interconnection procedures today already define non-export, but few have recognized limited-export specifically. In addition, many of the DERs installed going forward are likely to use a device called a Power Control System (PCS) to limit the export of energy to the distribution system. The PCS may be used alone or in conjunction with other means of controlling export, such as a utility grade relay. As Chapter III discusses, in order to capture the advanced capabilities of ESS, the interconnection procedures should describe the requirements and use of PCS. The following definition for PCS and the related concepts based on the IREC 2019 Model are provided here and will be relied on in later chapters:

> ***Non-Export*** *or* ***Non-Exporting*** *means when the DER is sized, designed, and operated using any of the methods in Section ___, such that the output is used for Host Load only and no electrical energy (except for any Inadvertent Export) is transferred from the DER to the Distribution System.*
>
> ***Limited Export*** *means the exporting capability of a DER whose Generating Capacity is limited by the use of any configuration or operating mode described in Section ___.*
>
> Note the blank section reference in the above two definitions should refer to a new section establishing acceptable export controls. Chapter III.E.2 discusses this section further and provides model language.
>
> ***Power Control System*** *or* ***PCS*** *means systems or devices which electronically limit or control steady state currents to a programmable limit.*
>
> ***Host Load*** *means electrical power, less the DER auxiliary load, consumed by the Customer at the location where the DER is connected.*
>
> ***Inadvertent Export*** *means the unscheduled export of active power from a DER, exceeding[26] a specified magnitude and for a limited duration, generally due to fluctuations in load-following behavior.*

3. Definitions of Nameplate Rating and Export Capacity

DERs with ESS often limit their output using a PCS, relay, or other means. It is useful for the interconnection procedures to have a defined term that describes the maximum amount of this limited output. The term Export Capacity is recommended, which can be contrasted with the DER's full Nameplate Rating:

[26] IEEE P1547.9 uses "beyond" rather than "exceeding."

> ***Export Capacity*** *means the amount of power that can be transferred from the DER to the Distribution System. Export Capacity is either the Nameplate Rating, or a lower amount if limited using an acceptable means identified in Section ___.*
>
> ***Nameplate Rating*** *means the sum total of maximum rated power output of all of a DER's constituent generating units and/or ESS as identified on the manufacturer nameplate, regardless of whether it is limited by any approved means.*

4. Definitions of Operating Profile and Operating Schedule

DERs with energy storage can control their import and export according to a fixed schedule, which we recommend calling an operating schedule. DERs based on solar generators (without ESS) have a maximum possible output that is less than the DER's Nameplate Rating. This is often called a solar output profile. It is useful for interconnection procedures to have a defined term that describes the maximum output possible in a particular hour based on the DER's operating schedule or resource characteristics, *e.g.*, solar output profile; we recommend calling this the operating profile:

> ***Operating Profile*** *means the manner in which the distributed energy resource is designed to be operated, based on the generating prime mover, Operating Schedule, and the managed variation in output power or charging behavior. The Operating Profile includes any limitations set on power imported or exported at the Point of Interconnection and the resource characteristics, e.g., solar output profile or ESS operation.*
>
> ***Operating Schedule*** *means the time of year, time of month, and hours of the day designated in the Interconnection Application for the import or export of power.*

5. Updates to Forms and Agreements

In addition to updating the definitions in the procedures, related interconnection documents—including the application forms, study agreements, and interconnection agreement—should also be updated to include appropriate terms and concepts related to energy storage. For example, interconnection procedures should acknowledge that ESS can be used to limit export to the grid in some or all hours. Further, the application forms should include fields for information on the type of energy storage technology to be installed, any proposed operating profile and/or use, both kilowatt (kW) capacity and kilowatt-hour (kWh) storage values, and other information that is particularly relevant for reviewing an energy storage application.