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Steel Wave Power
ABN: 72044918897

2 April 2014

State Development, Infrastructure and Industry Committee
QUEENSLAND PARLIAMENTARY SERVICE
Parliament House
Cnr George and Alice Streets Brisbane Qld 4000
Ph: 07 3406 7230 Fax: 07 3406 7500
mailto: sdiic@parliament.qld.gov.au

Dear Chair, Deputy Chair and Members,

Reference is made to the State Development, Infrastructure and Industry Committee inquiry being carried out into the Electricity and Other Legislation Amendment Bill 2014 and the associated documents published on the committee's website on 21 May 2003.

In the context of Alternative Energy Development on North Stradbroke Island, there are a number of issues associated with connecting Virtual Power Parks (i.e. 5-15 MW) in regional Queensland which have been discussed with DEWS, QCA and Ergon Energy.

Attention is drawn to the engineering paper dealing with Alternative Energy Development on North Stradbroke Island (NSI). This paper was presented in Auckland NZ on 17 September 2013 and published by CIGRE on its website on 22 October 2013. There it is seen as the imprimatur for Alternative Energy Development on North Stradbroke Island and is also fittingly oriented towards New Zealand and wider Oceania micro economies.

Steel Wave Power envisages several Virtual Power Parks in regional Queensland so has an interest in a number of issues discussed in the papers developed by DEWS, QCA and Ergon Energy and published on their respective websites. We would expect that most of these issues would receive due consideration during their review processes.

However, there is one matter that is particularly relevant to Steel Wave Power, which has only received a brief mention in the analyses by DEWS, QCA and Ergon Energy.

The specific matter deals with transitional arrangements associated with the progenitor NSI Virtual Power Park (i.e. 5-15 MW) connecting into its regional-grade distribution network, when negotiation with relevant stakeholders within its specific regional micro-economy may be swamped by constraints of external origin rather than local issues.

The situation which applies to North Stradbroke Island at this time is quite typical of regional QLD in the NEM (National Electricity Market), in that single contingency events have caused protracted separation of NSI micro-economic area (three times in last four summers) and thus give rise to a local requirement for partial contingency management.

The situation could also become more significant in regional QLD if, for example, existing micro-economic areas were augmented to contain a large amount of generation and comparatively little load, and/or there was an increase in interconnection(s) to NEM utilising non-firm distribution network powerlines or trading in ancillary services market.

It is therefore requested that some further consideration of this matter is warranted during the SDIIC inquiry with a view to a further **Amendment of s 55G (Restriction on Ergon Energy and its subsidiaries)** as follows:-

> Section 55G—
> *insert*—
> (2) b) for, or as part of, the program known as the Alternative Energy Development on North Stradbroke Island, administered through the Commonwealth's Australian Renewable Energy Agency and/or Australia's International Development Assistance Program; or

I would be pleased to discuss our submission at your convenience. Should you wish to discuss this submission in any way, please do not hesitate to contact Marcus DW Steel on [redacted]

Yours Sincerely,

Marcus DW Steel
Principal Application Engineer – SWP
(STEEL WAVE POWER)

References:

a) The CIGRE paper "Alternative Energy Development on North Stradbroke Island" by Marcus DW Steel
b) Compendium of Abstracts from CIGRE 2013 Symposium Session 6.1 Integration of Renewables
c) CIGRE's Closing Session summary B1/B2/B4/C6 at Symposium September 2013
d) Steel Wave Power presentation "Middle Child Syndrome – Neglected Distribution Connection"
e) "Provision of Ancillary Services by Distributed Generators, Technological and Economic Perspective" by Martin Braun - University of Kassel, Germany
f) "Least-cost Planning for 21st Century Electricity Supply - Meeting the Challenges of Complexity and Ambiguity in Decision Making" by Mark Cooper - Senior Fellow for Economic Analysis, Institute for Energy and the Environment, Vermont Law School.

Welcome to the CIGRE Symposium "Best Practice in Transmission and Distribution in a Changing Environment" and associated meetings.

Tuesday 17th September
10.40 – 12.20 Concurrent Session:

Compendium of Abstracts from CIGRE 2013 Symposium Session 6.1 Integration of Renewables

6.1 Accurate and realistic regional forecast of renewable infeed in power systems

J. KAYS, A. SEACK, C. REHTANZ
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TU Dortmund University
Germany

The increasing number of renewable power plants leads to changing supply situations, especially in distribution grids, where the power flow alters between unidirectional and bidirectional manner in certain situations. The distribution system operator needs to forecast situations where the renewable feed-in is dominating the system to avoid congestions and ensure system stability.

The exact position and system parameters of renewable feed-in units is often unknown to the electric system operator and measurement values are often only available for units in high voltage grids and not required for small renewable feed-in units today. Therefore it is very difficult to forecast the renewable feed-in curves in low and medium voltage power systems, although this has also an impact on the operation of the overlaid high voltage grids. A modular and universal approach for a renewable forecast system is developed to solve this shortcoming. Every renewable feed-in unit is represented by a single agent in the system, which enables an arbitrary level of detail of the renewable forecast and is easy to extend. Photovoltaic and wind energy plants are used to demonstrate the system, which take into account local weather conditions. The system has a forecast horizon of several hours, which is depending on the provided weather data.

With the developed forecast system a system operator is able to calculate a realistic forecast of non-measured renewable feed-in within a defined supplied area. The area can be chosen by the system operator according to the required level of detail. This enables the system operator to forecast congestion in the electric supply system and to take countermeasures. The forecast system can increase the available reaction time of the system operator and therefore increases the security of supply in the system.

6.2 Accurate and realistic regional forecast of renewable infeed in power systems

P.J. PALERMO, K. CHEN, D.M. KORINEK
DNV KEMA
United States

A number of recent studies examined the impact of increasing wind and solar generation on numerous island systems. Since these island systems are typically small—between 500 kW and 100 MW—even small amounts of solar and wind renewable generation can have a large effect. The techniques and methods developed, and the lessons learned are applicable to larger systems.

These island studies found five important variables that must be addressed when evaluating high levels of renewable energy generation penetration:

1. Hourly patterns of customer load, and wind and solar generation output—the best combination of wind and photovoltaic depends on costs and the hourly patterns of wind and insolation patterns, geography, and economic development.
2. Inertia and system control—perhaps the factor that most limits the penetration of renewable energy generation is maintaining stable operation during light-load conditions when the least conventional generation operates needed to provide rotational inertia, spinning reserve, and regulate system voltage.
3. Intra-hour patterns of renewable energy generation—with both wind and PV, intra-hour variability from cloud movements and gusty winds is an important concern.
4. Location-related problems—are related to the physical location of renewable energy generation, especially wind, can be very location-specific.
5. Inverter-related problems—inverters are designed to disconnect when system voltage or frequency is outside a specified range to protect the inverter and the system. As renewable energy generation penetrations increase, misoperation of this protection scheme becomes a serious concern.

Each of these is discussed along with available solutions, including examples from the island systems.

6.3 The role of the network planning process in upgrading network functionality to meet the requirements of independent power producers

Horvath G. C
AECOM
New Zealand

The relevance and the implications of Distributed Resources (DR) to the Network Services provided by network services providers is trying to undergo a revolution, which reflects the strong emphasis being placed on the uptake of DR within the energy policies of many countries. However, a bottleneck has formed through the inability of the energy networks to respond to the needs of DR at the volumes which would reflect the aspirations of the policy makers. This paper explores the idea that if the connection requirements of DR were integrated into the NSPs' planning processes then, more convenience and assurance could be achieved for DR proponents, thereby reducing the well-known non-price barriers to DR connection that has been a back-wind in realising the energy policies of many jurisdictions.

The approach suggested in the paper, is to consider the accommodation by NSPs of the needs of DR, (whether it be wind resource, or PV, or a range of other resources such as intermittent storage), as a range of new Network Services that an NSP needs to provide at its points of interconnection with the grid. Then, through the normal Planning Process, and through the governance provided by the regulator, an NSP can work systematically, a) to define the levels of the new Network Services that it is able to provide at each POI; and b) to match the network capability to the expected demands for these Services that will manifest over the current planning cycle. Any shortfall can then be made good through the normal regulatory approval of CAPEX.

Certainty is provided to prospective DR connectors through framing the new Network Services so as to be supportive and complying with their needs. However the expected impacts on the network of the forecast demand for DR connections, and therefore the new network services, are determined by the normal techniques of simulation utilised in a standard planning processes.

6.4 Alternative Energy Development on North Stradbroke Island

Marcus DW Steel
Steel Wave Power
Australia

Unimin's Sustainability Manager – Mineral Sands saw on 29th July 2010 the potential for wind power in the eastern section of the Ibis mine area while exploring for an outcome of an alternative energy project that is capable of providing sustainable power solutions for post mining on North Stradbroke Island (NSI), east of Brisbane. Compare this with Flinders Island, situated mid-Bass Strait and exposed to Roaring 40s, having one of the best wind regimes in the world but solar irradiation is low during winter.

The overarching development concept is a precinct solution at Edge Of Grid and electricity distribution utility has confirmed that NSI qualifies as such irrespective of proximity to Brisbane (population 2,146,577 in 2011). North Stradbroke Island is adjacent to the Gold Coast boasting 300 sunny days a year yet where the wind regime is rarely Roaring 40s strength. Resort occupancies on NSI are highly seasonal so behind-the-meter energy efficiency improvements and solar PV / energy storage installation is restricted to "below firm load" in the current regulatory environment.

A recent regulatory study by an electricity distribution utility at external examples of Edge Of Grid shows there is a local community level benefit for meeting the firm load of a community before Power Purchase Agreement (PPA) actually needs to be considered, that is no export from zone transformers. But integration of many energy storage and renewable generation units into a distribution network substation at NSI possibly will have significant implications for means of peak demand management, the coordination 110/11kV Tap Changers, effective fault level for safe protection operation and commissioning tests of the coordinated system, because the required control system differs radically from previous schemes (shedding hot water loads, etc.).

Distribution Zone Substation refurbishment project and a project to proactively solve Emerging Distribution Network Limitations is an archetypal capital deferral for electricity distribution utilities. These two projects de-constrain and de-risk the distribution network for major energy investment streams on the other side of distribution network connection points. The latter of these projects requires an Integrated Volt/VAR Control (VVC) Decentralized with Distributed Power System Auto-Control solution. A Circuit Reconfiguration Controller associated with VVC control area is needed for rapid fault location, isolation and supply restoration scenario and its implementation using IEC 61499 function blocks.

One major investment stream is MW class solar PV facilities that may be located in areas that fit in with a very large protected area (80% of NSI) to become National Park by 2027 and could generate enough electricity to power nearly 900 homes on the Island. These developments are for Independent Power Producers (IPP) interested in the grid-connected supply of electricity generated by renewable energy under a long-term PPA.

Thus, distribution network constraints on the corridor back to transmission substation may possibly lead to a runback scheme, thereby potentially increasing dimensions of technical issues. This paper studies potential technical issues associated with the integration of a multi renewable Ethernet-based sustainable energy system on the consumer-side and within a conventional distribution network that has traditional distribution network constraints.

6.5 Best practice in smart grid applications for distributed electricity networks An overview of Austrian and European Research and Pilot Projects

Daniel BURNIER DE CASTRO, Sawsan HENEIN, Stefan ÜBERMASSER, Johannes STÖCKL, Helfried BRUNNER, Johannes KATHAN, Serdar KADAM
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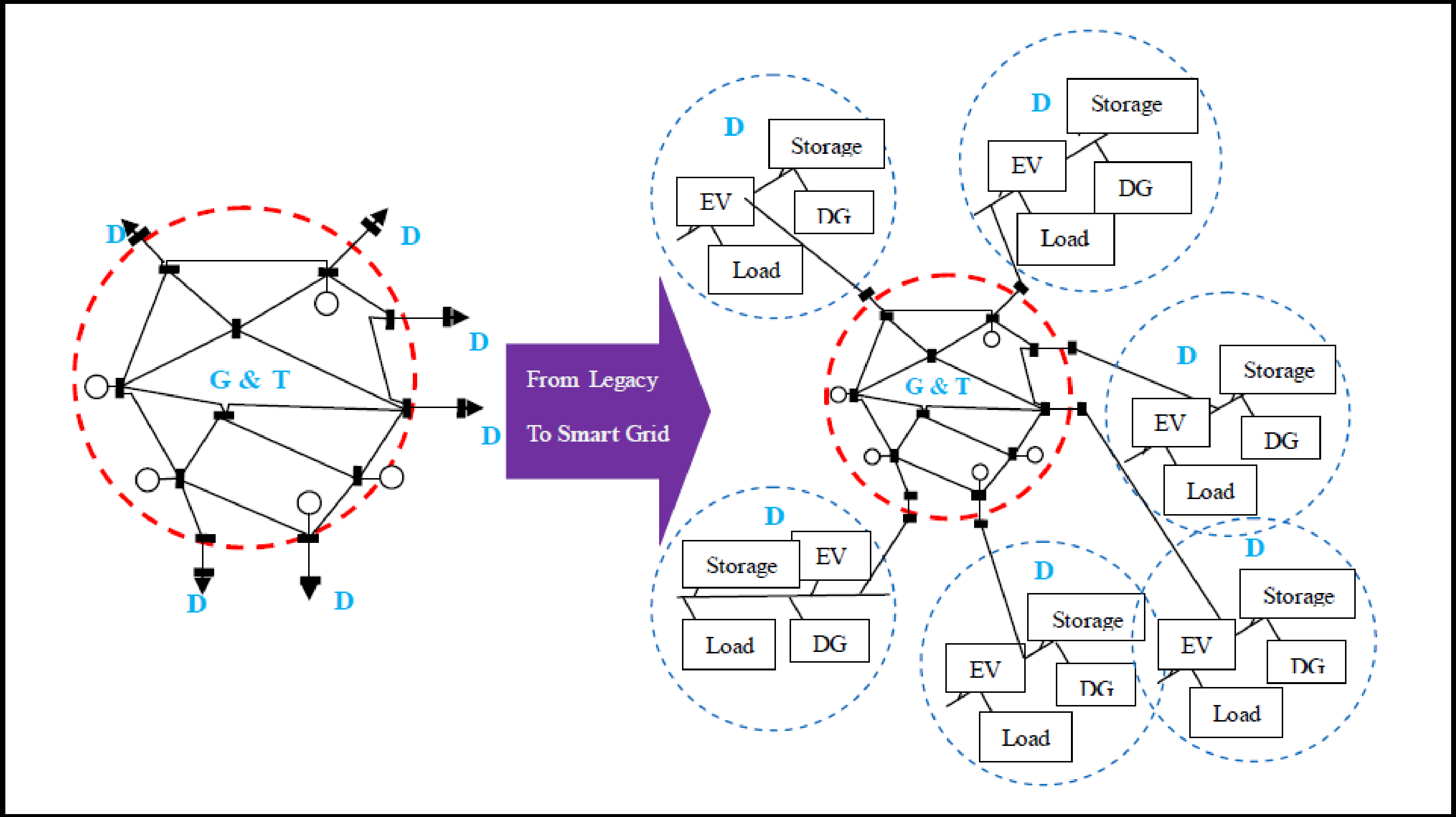
SUMMARY

Since the European Union created a community framework for promoting renewable energy sources for electricity production, national targets for generation of electricity from renewable sources of energy were established. The fulfillment of these targets requires efforts to improve the efficiency, reliability, economics, and sustainability of the generation and distribution of energy. Currently, one of the main challenges in distribution networks is to increase the capacity for accommodation of the arising amount of renewable energy, which is mainly distributed and in many cases of an intermittent nature. One approach for handling this problem is to evolve the existing power grid towards a socalled Smart Grid.

The Austrian Institute of Technology participates in a variety of national and international projects, where smart grids are a main subject. Especially the impact of the integration of different energy sources, but also additional loads and consumers, on the network stability and power quality have been largely investigated within these projects. A concept for this purpose was developed, with focus on active voltage control by different elements existent in the distribution networks. In a first step this concept was introduced to medium voltage networks and tested in a simulation environment for different generation development scenarios. Within different projects the concept was refined and finally applied in field tests in real networks. Results show that the introduction of this concept can avoid or postpone expensive network expansions even at a high penetration of distributed renewable generators. Lately the focus of different research projects has been moving towards low voltage networks, which represent an even bigger challenge, since information about their active state and condition is very limited. Project results show that low voltage grids are the first voltage level where voltage problems due to the integration of renewables like photovoltaic and new loads, like electric cars are perceived. The definition of all these concepts, their further development and later, their test in the laboratory and field shall help to a better understanding and definition of the smart grid of the future.



STEEL WAVE POWER is focusing on shifting from 'G&T' towards 'D' in Smart Grid

AND

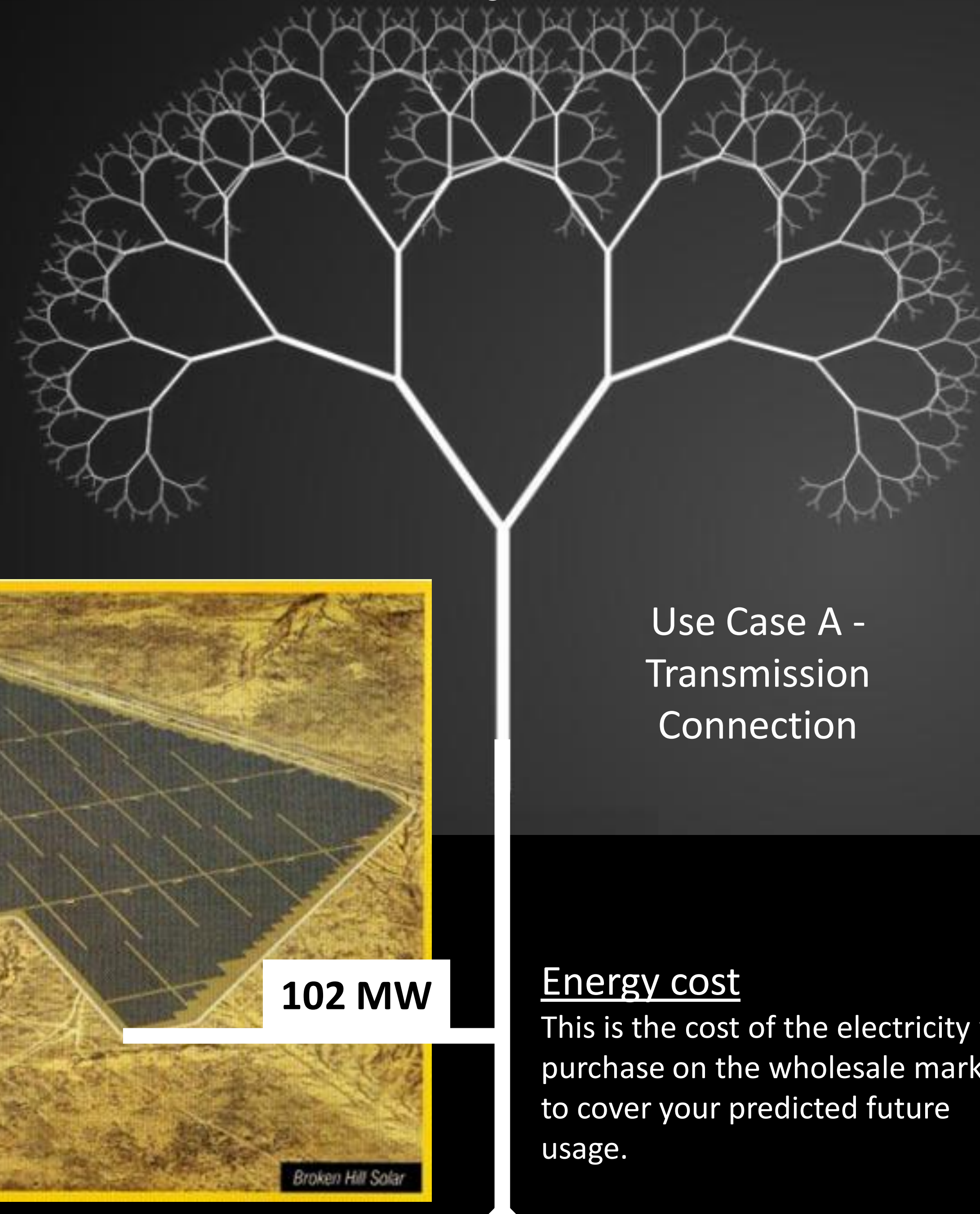
5-15 MW Solar PV Energy facilities are an ENABLER

Middle Child Syndrome – Neglected Distribution Connection

Infrastructure costs

These relate to the costs of providing the infrastructure required to deliver your power. They include the cost of energy lost (as heat) as it travels from the solar PV energy facility, through the transmission and distribution wires to you. These charges are referred to as Transmission Loss (Tloss) or Distribution Loss (Dloss). They also charge for using the transmission and distribution networks; referred to as Transmission Use of System (TUoS) and Distribution Use of System (DUoS).

50,000 average-sized houses



Use Case A - Transmission Connection

Energy cost

This is the cost of the electricity we purchase on the wholesale market to cover your predicted future usage.

Use Case B - Distribution Connection (Virtual Power Park)

Infrastructure costs

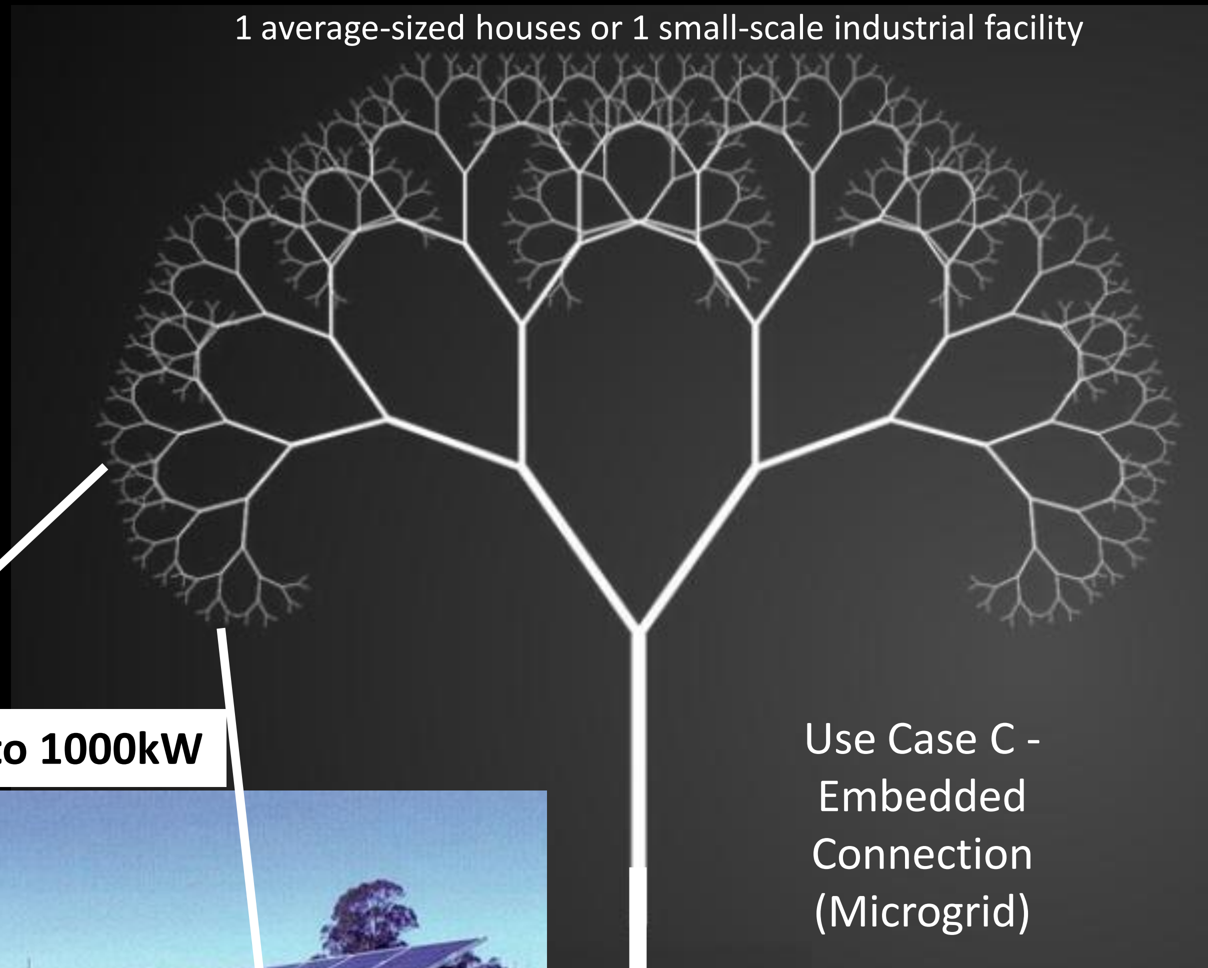
These relate to the costs of providing the infrastructure required to deliver your power. They include the cost of energy lost (as heat) as it travels from the solar PV energy facility, through a small portion of the distribution wires to you. These charges are referred to as or distribution loss. They also charge for using a small portion of the distribution network; referred to as Distribution Use of System (DUoS).

Energy cost

This is the cost of the electricity we purchase on the wholesale market to cover your predicted future usage. This cost can be greater than Use Case A as all TUoS and some DUoS charges should be avoided.

Infrastructure costs

These relate to the costs of providing the infrastructure required to deliver your instantaneous power need not met by your embedded solar PV generation.



30kW to 1000kW

Energy cost

This is the cost of the electricity we purchase on the wholesale market to cover your predicted future usage. This cost may be greater than Use Case A due to less energy drawn from grid.

Closing Session summary SC B1/B2/B4/C6

5.1 AC & DC: Traditional HVDC and FACTs devices are now conventional tools whose ability to enhance grids and stabilise AC systems are well recognised. A number of algorithms have been developed over time to overcome the inherent technical challenges of conventional HVDC. Relatively small amounts of energy storage coupled to the grid through FACTs devices may significantly improve power system dynamic performance and stability.

6.1 Integration of Renewables: The papers presented a coherent picture of components of work being undertaken, which will ultimately come together in a new energy grid which is run on renewables, but which is well planned and operated, and which is even more stable, as it supports a diverse range of new technologies and business models.

6.2 Optimisation: The increasing penetration of PV and wind generation in transmission and distribution grids entails new techniques to control reactive power production and voltage regulation. The variability of PV generation needs a better meteorological forecast. An agent based model to forecast PV feed-in may be useful for this purpose.