DIRECT STATEMENT OF
MATTHEW J. HAMMOND
ON BEHALF OF
SOUTH CAROLINA ELECTRIC & GAS COMPANY
DOCKET NO. 2015-362-E

My name is Matt Hammond. I am employed by South Carolina Electric & Gas Company ("SCE&G"), where I currently serve as the Manager of Electric Transmission Support within SCE&G's Transmission Department. In this role, I am SCE&G's primary customer interface for all wholesale users of the bulk electric system. I am responsible for the administration of SCE&G's Open Access Transmission Tariff (OATT), transmission contract administration and customer billing. I also administer SCE&G's generator interconnection programs for both South Carolina and Federal Energy Regulatory Commission (FERC) jurisdictional interconnections.

The purpose of my statement is to present the current status of SCE&G's generator interconnection processes for South Carolina jurisdictional projects. The Commission approved an interconnection standard for South Carolina jurisdictional interconnections on or about April 26, 2016. This standard is known as the South Carolina Generator Interconnection Procedures or SCGIP.

Summary of the SCGIP

The SCGIP applies to all state jurisdictional projects up to 80 MW in size. It contains three distinct processes to evaluate interconnecting generators: 20 kilowatt (kW) Inverter Process, Fast Track Process and the Study Process. The 20 kW Inverter Process is an abbreviated, one-step process and is typically associated with residential and small

1 commercial customers. The SCGIP also includes a pre-defined reserved circuit capacity
2 for these projects. This reserved capacity serves two purposes. First, it provides a pre-
3 approval for these smaller projects which results in a quick, streamlined interconnection
4 process. And second, the reserved capacity ensures that one or two large projects do not
5 occupy all available capacity on the utility's circuits, thereby locking out all homeowners
6 and businesses from adding renewable generation resources.

7 Larger projects, up to 2 MW, can apply under a Fast Track Process. This process
8 incorporates pre-defined screens to evaluate inverter-based generators. If a project passes
9 the screens, it moves to an interconnection agreement. If it fails the screens, the project
10 may still be evaluated under a Supplemental Review process.

11 Projects greater than 2 MW, and projects that are ineligible for the above-mentioned
12 processes, are evaluated under a Study Process. The Study Process typically includes a
13 System Impact Study and a Facilities Study.

14 Once a project has been studied and approved, it executes an Interconnection
15 Agreement (IA) with the host utility. Upon execution of the IA, upgrade and dedicated
16 facility costs must be paid within 45 business days to remain active and in queue.

17 Generation projects also have the option of requesting a Pre-Application Report.
18 This report provides a snap-shot of the Utility's system at the point of interconnection.
19 This information can be used to quickly evaluate the merits of a proposed facility. This
20 can save both renewable developers and utilities from spending valuable time on projects
21 that are likely to trigger expensive system upgrades. Pre-Application requests do not
22 establish a position in the interconnection queue.

1 **SCE&G's Interconnection Activities**

2 As a result of the interest spurred by Act 236, generation interconnection activities
3 at SCE&G have increased dramatically. My department, Electric Transmission Support,
4 has three full time employees focused on administering interconnection activities.

5 In addition, numerous employees across SCE&G have assisted with evaluating solar
6 interconnections and developing policies and procedures to safely and reliably interconnect
7 utility-scale solar to the SCE&G system. These groups include Distribution Planning,
8 Transmission Planning, Relay Applications, Power Delivery Engineering (both substation
9 and transmission), Operations Support, System Control and many others. In most cases,
10 these activities are distinct from the work that Mr. Raftery describes in his statement.

11 When the SCGIP was approved by the Commission, SCE&G created a webpage
12 specifically for solar developers. The webpage, including the SCE&G queue, can be found
13 at www.sceg.com/interconnection. The webpage provides a brief summary of the SCGIP,
14 the full SCGIP for reference, an SCE&G Interconnection Customer Guide (which is a
15 graphical cliff-notes version of the SCGIP), contact information, FAQs and more.

16 As of October 31, 2016, SCE&G has received 183 valid state jurisdictional
17 interconnection requests totaling 2,002 megawatts (MW). For comparison, SCE&G
18 Transmission had received 40 interconnections in the preceding 10 years. SCE&G has
19 provided over 70 pre-application reports to solar developers. Of the requests for
20 interconnection, 77 projects totaling 788 MW, remain active and in queue.

21 The remaining projects have been withdrawn from queue for a number of reasons.
22 Importantly, SCE&G does not deny and has not denied interconnection requests. Through

1 the evaluation process identified above, SCE&G determines the upgrades, if any, necessary
2 to accommodate a project. The project then has the option of moving forward based on
3 that information. There is one unique part of the SCE&G system where SCE&G may not
4 be able to approve a large interconnection request and that is the downtown Columbia
5 secondary network system. To date, SCE&G has approved the interconnection of small
6 solar systems to that network but it has not received any utility scale interconnection
7 requests in that area.

8 SCE&G has seen projects withdrawn from the interconnection queue for numerous
9 reasons and at every step of the interconnection process. It is common for projects to
10 withdraw after receiving the results of the system impact study. The project may have been
11 too large for the existing electrical infrastructure in the area, resulting in higher than
12 expected upgrade costs.

13 We frequently see projects withdraw due to the consequences or uncertainty of
14 being behind other projects in queue. Once a project has successfully applied for
15 interconnection, SCE&G assigns that project a place in the interconnection queue. The
16 project holds that position as long as the project remains active. If a second project applies
17 for interconnection in the same electrical area, SCE&G must assume the first project is on-
18 line and fully operational in all studies associated with the second project. This
19 compounding of projects can result in significant system upgrades and uncertainty for both
20 the solar developers and the utilities. This queueing uncertainty was never more apparent
21 than in the Blackville area. Over the course of the last year, SCE&G saw eight projects
22 totaling 135 MW proposed behind one 28 MVA transformer.

1 SCE&G is up to date on its application and study requirements associated with the
2 SCGIP and interconnecting projects. Hurricane Matthew did introduce a significant
3 disruption to normal interconnection work. That created a few missed deliverables from
4 both SCE&G and our interconnecting customers. Since electric restoration efforts
5 concluded, those projects have all gotten up to date.

6 **Typical Interconnection Facilities**

7 I would like to take a few moments to describe the basic interconnection facilities
8 for different projects. Projects that are net metered or that are co-located with traditional
9 customers tend to have the least impact on the SCE&G system and require little to no
10 dedicated equipment or system upgrades. These projects are typically smaller than 20 kW
11 but they can be much larger. For example, a large retailer can locate 200 kW or more of
12 solar panels on its rooftop.

13 Distribution utility scale projects tend to have a more meaningful impact on the
14 electric system. These projects typically range in size from 1 MW to 10 MW or more. The
15 minimum interconnection facilities for distribution projects of this size is approximately
16 $75,000. Many of these projects also require upgrades to the SCE&G distribution
17 substation to accommodate reverse power flow. These upgrades cost around $150,000. It
18 is also not uncommon to see interconnection costs of several hundred thousand dollars for
19 projects this size if additional upgrades are required. An example would be replacing the
20 primary conductor or rebuilding a pole line that also contains transmission assets.

21 Transmission level interconnections require switching stations that are similar in
22 scope to an SCE&G distribution substation. For the 46 kV sub-transmission system, a

typical switching station costs around $800,000. A 115 kV switching station costs around $1,500,000 while a 230 kV switching station costs around $2,200,000. These systems can accommodate much more energy so the increased interconnection costs can be offset by larger project sizes.

Interconnection Example

At this time, I would like to address a common situation we are experiencing across SCE&G's service territory. This example will help explain some of the complexities we and solar developers experience when multiple projects are proposed in the same electrical area. Please refer to Figure 1 below. In this example, Project A applied for interconnection first, followed by Project B, then Project C. Please note that I have simplified this example by ignoring system load and impacts to power quality which can be important in many situations.

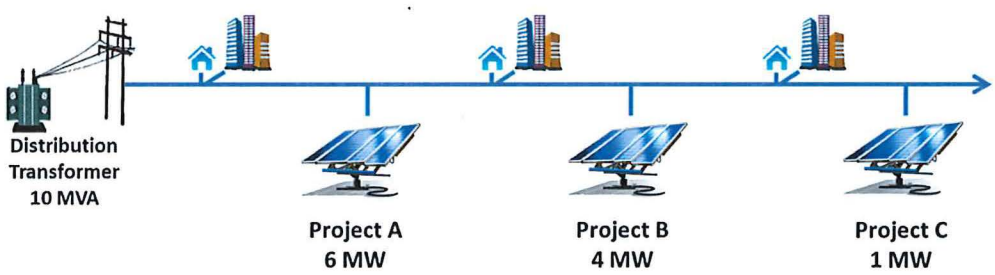


Figure 1

Project A requested to interconnect a 6 MW project to the existing 10 MVA distribution transformer. Interconnection costs will total $225,000. Of that, $150,000 is for substation upgrades to accommodate reverse power flow. The remaining $75,000 is for a standard package of equipment needed for every solar interconnection of this size and type.

1 Project B can add an additional 4 MW (10 MVA transformer size less the Project A
2 6 MW) without triggering additional system upgrades. Project B can interconnect simply
3 by procuring the basic dedicated facility package totaling $75,000.

4 The final project in this example, Project C, will overload the existing transformer
5 and can only interconnect if SCE&G modifies the existing substation by increasing the
6 transformer size or by adding a second transformer. This is a relatively expensive upgrade
7 that might cost as much as $2,000,000. Project C would also be responsible for the standard
8 dedicated equipment charges of $75,000.

9 Project C has a decision to make. Should it withdraw from the queue and incur no
10 additional study costs or should it try to hold its place in queue by continuing the
11 interconnection process with the hope that Project A or B fail to progress?

12 To continue this example, let's now assume that Project A withdraws from the
13 queue for some reason. Project B is now first in queue at this substation and will therefore
14 be responsible for the $150,000 cost to modify the substation to accommodate reverse
15 power flow. This risk would have been identified during the interconnection process but
16 only Project B can decide if it should absorb that cost and continue to develop the project.

17 If Project C stayed in queue, its position will have improved dramatically. Its
18 interconnection cost would drop from $2,075,000 to $75,000. It may now be a viable
19 project.

20 Project A can resubmit its interconnection application; it would be in queue behind
21 Projects B & C. At 6 MW, Project A will trigger the transformer upgrades described earlier
22 for Project C. The more likely scenario is that Project A, if it decided to resubmit, would

request 5 MW. At that level, it wouldn't trigger the substation upgrades and its cost to interconnect would be $75,000.

This example demonstrates some of the complexities associated with the interconnection process experienced by utilities and solar developers in areas where multiple projects are proposed. It also demonstrates how projects lingering in the queue can complicate, or even halt, the development of other solar projects that would otherwise be viable.

Operational Example of Interconnected Utility Scale Solar

I would like to walk through an additional operational example that will impact SCE&G and solar projects. Most of SCE&G's electric distribution system is designed to connect to an alternate portion of the system. This allows SCE&G flexibility to serve as many customers as possible during routine maintenance and unplanned emergencies. Please refer to Figure 2 below.

Figure 2

In this schematic, the electrical distribution system between Hopkins and Eastover contains several switches. There is also a switch between the two circuits that is normally open. SCE&G can close this switch when necessary to support service to its customers.

Now assume that a tree falls on a section of the Hopkins line. Please see Figure 3. That unplanned event will disrupt power to the entire distribution feeder. Due to the

operational flexibility SCE&G plans into its system, SCE&G can isolate the downed lines from the rest of its system and restore power to most of its customers in short order. In many places across the SCE&G system, this switching can be done remotely and in minutes due to the real-time information and operational control afforded by SCE&G's Supervisory Control and Data Acquisition (SCADA) system. Figure 4 shows the system after the downed lines have been isolated.

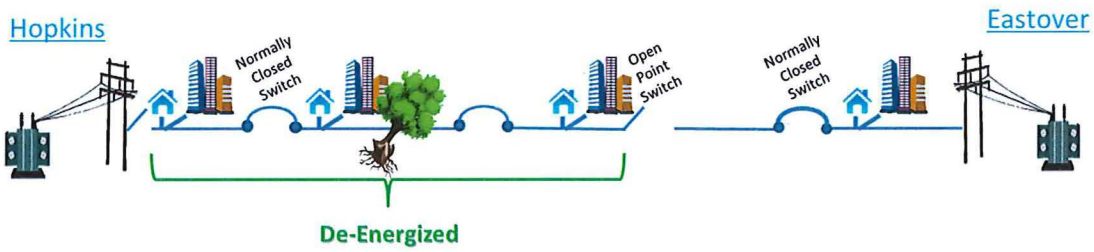


Figure 3

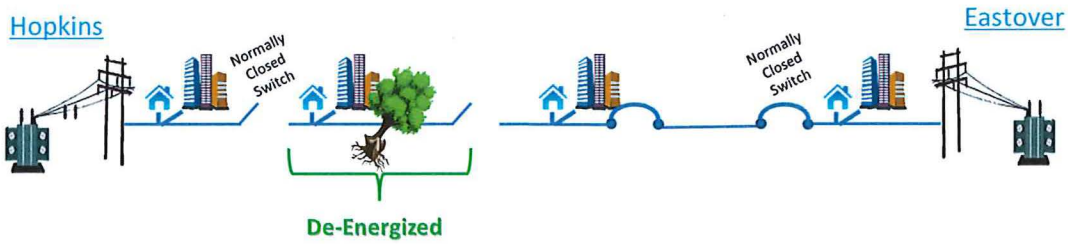


Figure 4

To continue the example, assume that a utility scale solar farm successfully interconnects to Hopkins line. As is very common with utility scale projects, SCE&G must modify its system to properly handle the new power flows. In this case, SCE&G replaced the existing conductors to a larger size and modified the substation to accommodate reverse power flows from the solar farm. Please see Figure 5. Solar facilities connected to the distribution system, or radial sections of the transmission system, request one primary path

on the system. SCE&G only studies this primary path during the interconnection process. When that primary path is unavailable, the solar facility must be disconnected from the system for several reasons. An interconnecting generator could request an alternate path but that is generally consider too costly. To date, no generation project on the SCE&G system has opted to pursue the upgrades necessary to secure an alternate path.

Figure 5

In the downed tree example from above, when SCE&G isolates the damage power lines, the solar facility must also be disconnected from the system. This ensures that the output of the facility doesn't damage SCE&G equipment or negatively impact other customers. Please see Figure 6.

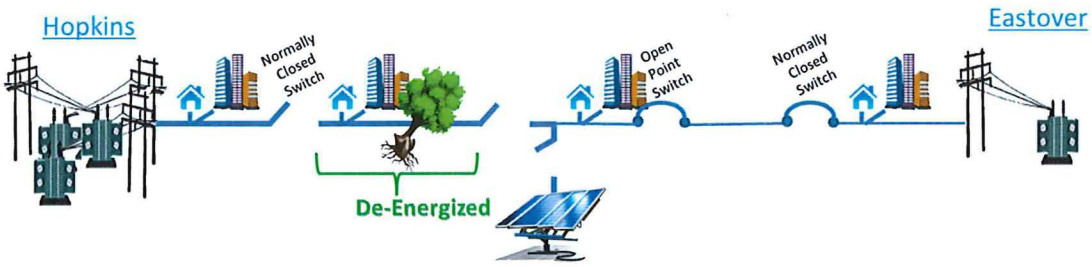


Figure 6

Another component of SCE&G's operation of the electrical system is routine, preventative maintenance at distribution substations. Several components of this maintenance requires substation transformers and breakers to be removed from service. In

these situations, distribution circuits are served from other parts of the system. As before, when that primary path for the utility scale project is unavailable, the project must be offline and isolated from the system. Please see Figure 7 for an example of a typical configuration of the Hopkins circuit during maintenance of the substation.

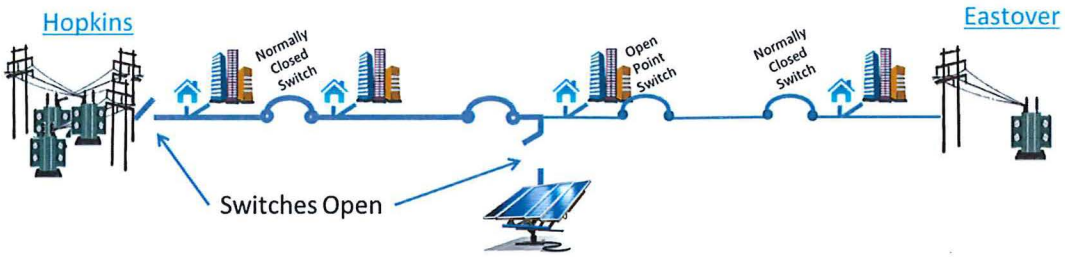


Figure 7

Conclusion

In conclusion, Act 236 has spurred significant interest in adding solar generation in South Carolina. Of the active projects in the SCE&G queue, 37 projects totaling approximately 273 MW have executed interconnection agreements and made meaningful progress toward the construction and interconnection of their projects. While this does not guarantee their completion, it may be a good indication of how much solar SCE&G can expect to see connected to its system in 2016 and 2017. Thank you.

SCE&G Interconnection Update

PSC WORKSHOP

DECEMBER 15, 2016

SCE&G
A SCANA COMPANY

Summary of the SCGIP

20 kW Inverter Process

- Pre-defined reserved capacity

Fast Track Process

- Supplemental Review

Study Process

- System Impact Study
- Facilities Study

Interconnection Agreement

- Upfront payment of interconnection facilities and upgrades due with 45 business days of execution of the agreement.

Pre-Application Report

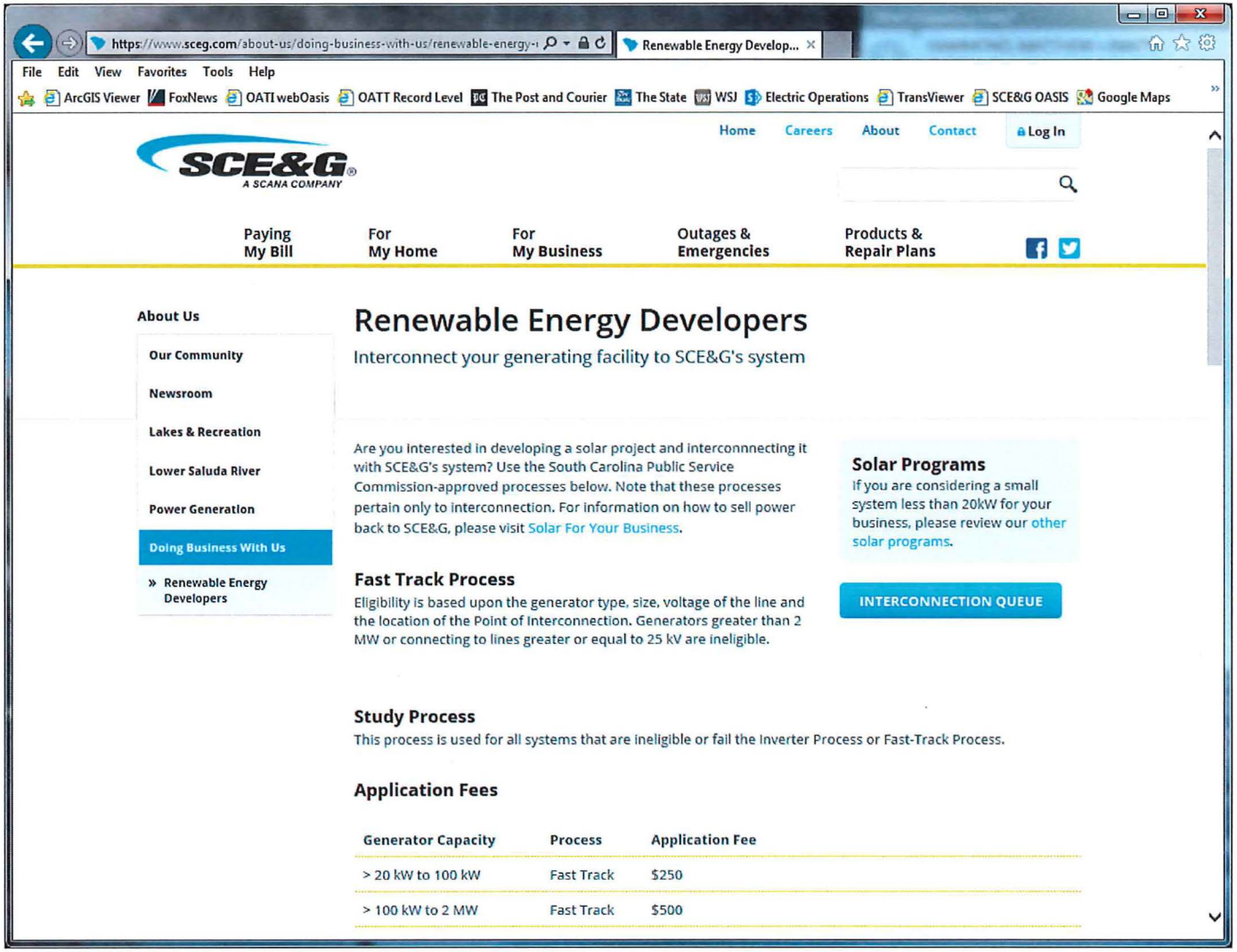
SCE&G Experiences to Date

183 Interconnection Requests received totaling 2,002 MW

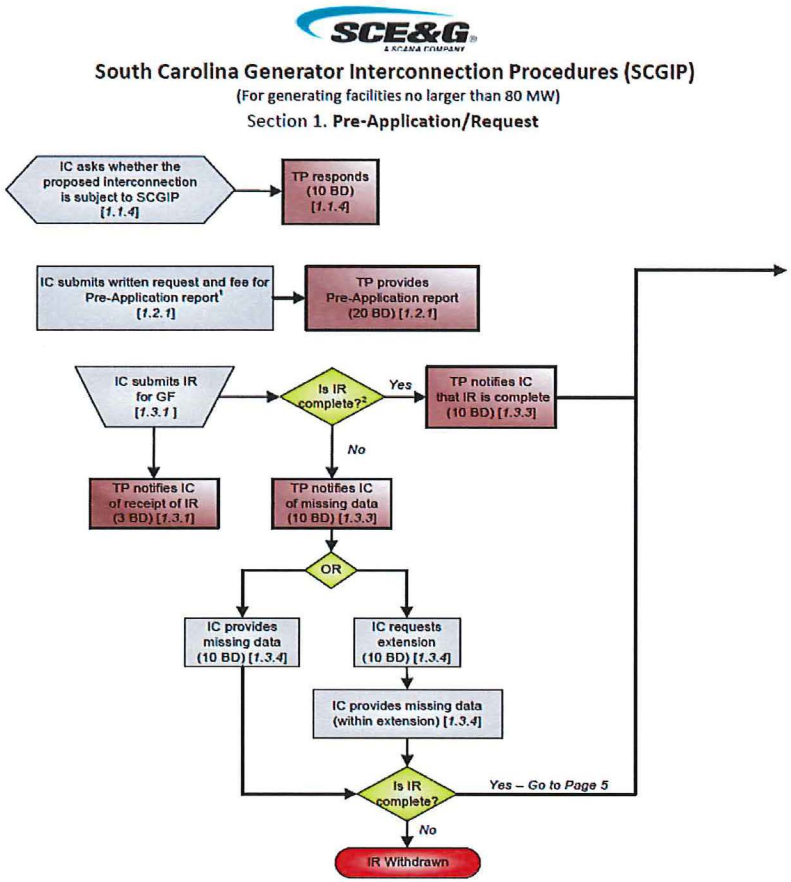
Over 70 Pre-Application Requests Processed

77 projects remain active totaling 788 MW

Webpage Developed for Generation Interconnection Activities
www.sceg.com/interconnection



Sample from SCE&G's SCGIP Customer Guide



Typical Interconnection Facilities

System Co-located with traditional customers

- Smaller in size with less impact to the SCE&G system
- Interconnection cost tend to be low

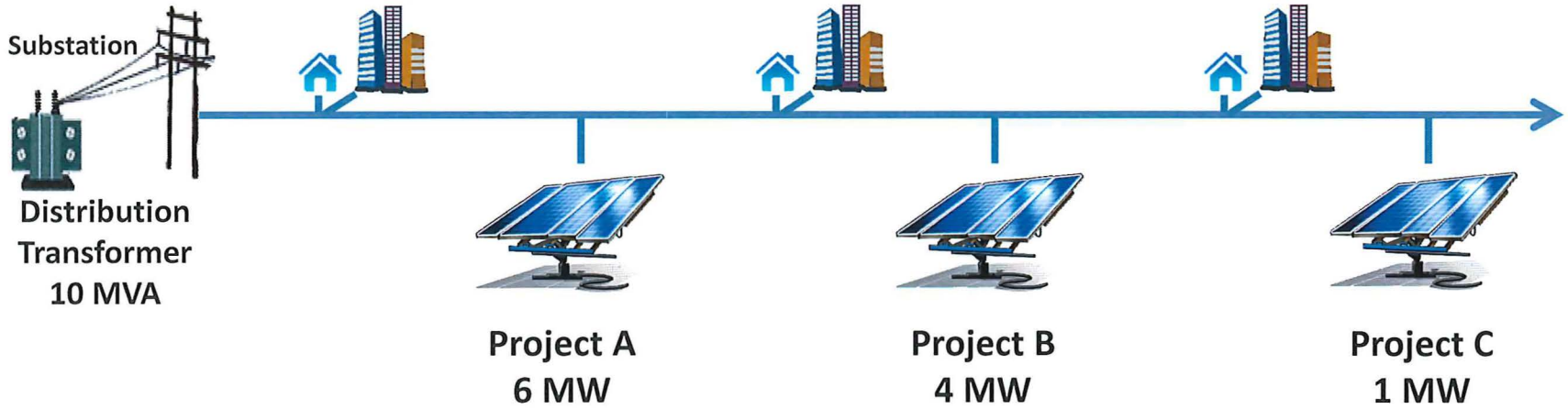
Distribution Interconnections

- More impactful to the SCE&G System
- Projects above 1 MW must install a basic interconnection package that costs around $75,000.
- Typically require modifications to the substation that cost ~$150,000.

Transmission Interconnections

- 46 kV Switching Stations cost ~$800,000
- 115 kV Switching Stations cost ~$1,500,000
- 230 kV Switching Stations cost ~$2,200,000

Interconnection Queue Example

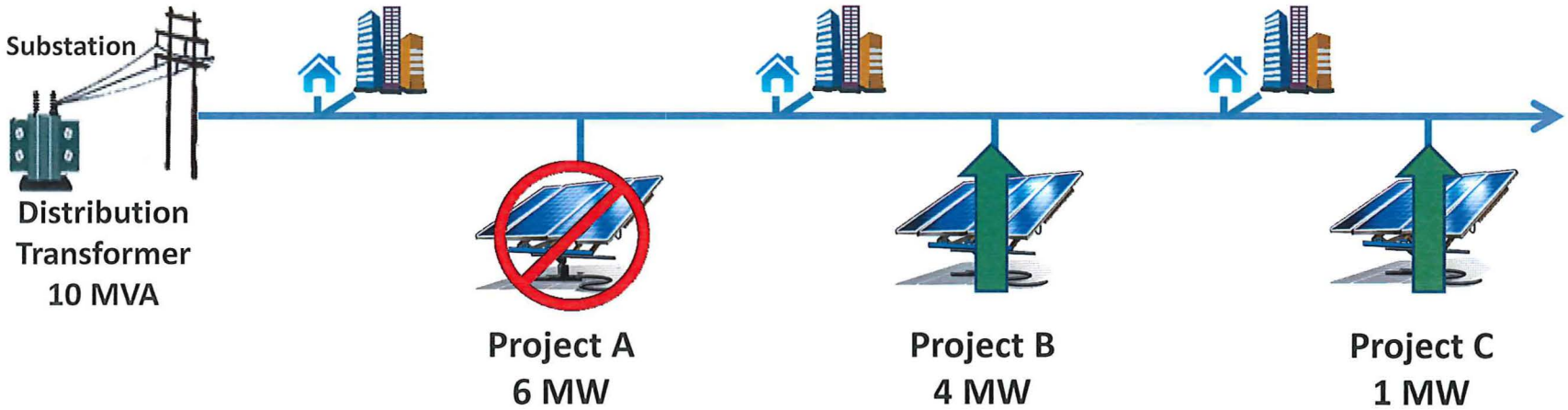


Project A: First in queue – Interconnection costs total $150,000 for substation upgrades to accommodate reverse power flow + $75,000 for direct facilities.

Project B: Second in queue – Interconnection costs total $75,000 for direct facilities.

Project C: Third in queue – Interconnection costs total $2,000,000 for a new distribution transformer + $75,000 for direct facilities.

Interconnection Example
Project A Misses a Deadline!



Project A: Drops from Queue – If they resubmit, Interconnection costs total $2,000,000 for a new distribution transformer + $75,000 for direct facilities. Project may be successful at 5MW.

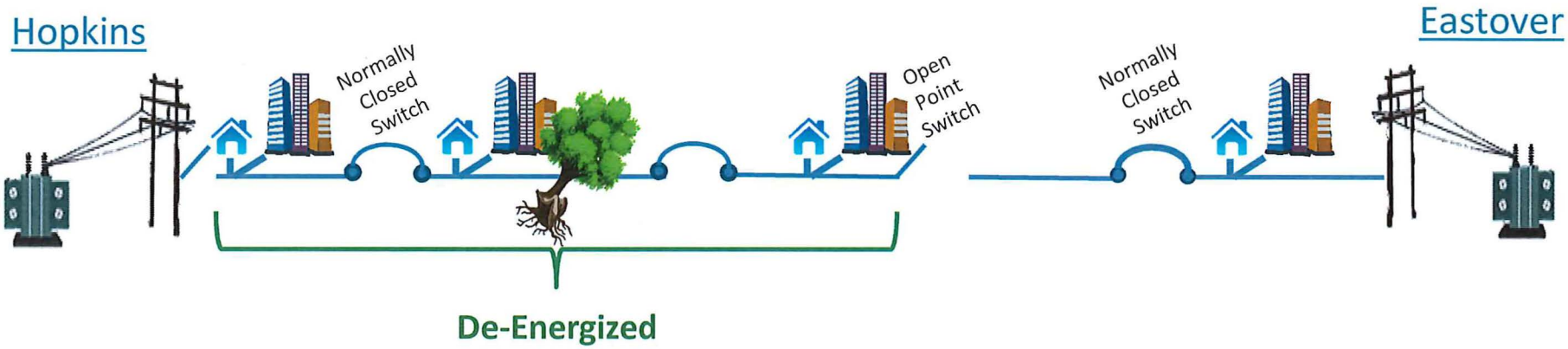
Project B: First in queue – Substation upgrades shift to this customer. Interconnection costs total $150,000 for substation upgrades + $75,000 for direct facilities. Project may want to increase its size.

Project C: Second in queue – Project may now be viable. Interconnection costs total $75,000 for direct facilities.

Typical Distribution Configuration

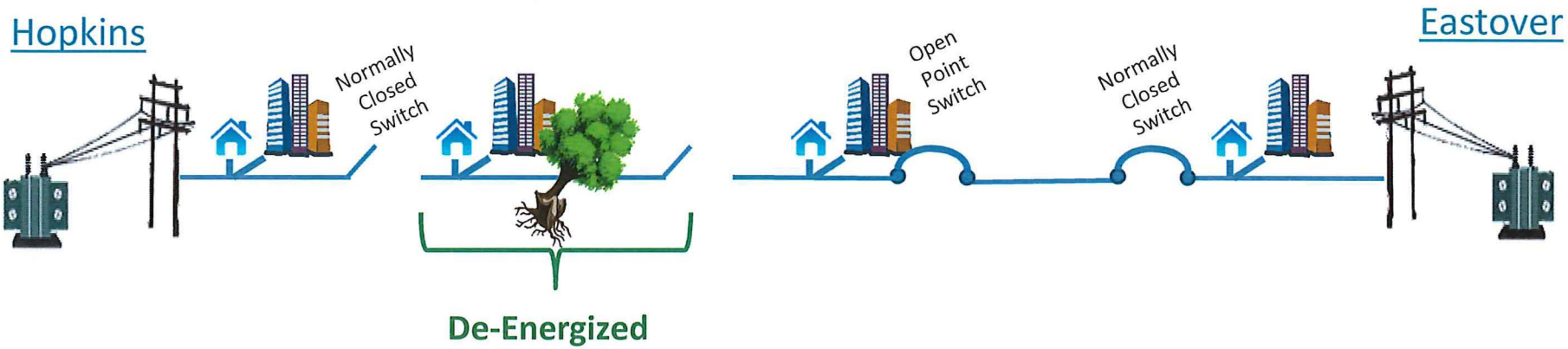
Typical distribution circuits have built in flexibility due to normally closed and normally open switches installed on the system.

Normal Configuration



If a tree falls on line, it will de-energize the distribution circuit.

Switched Configuration



SCE&G can isolate the problem and pick up many customers quickly.

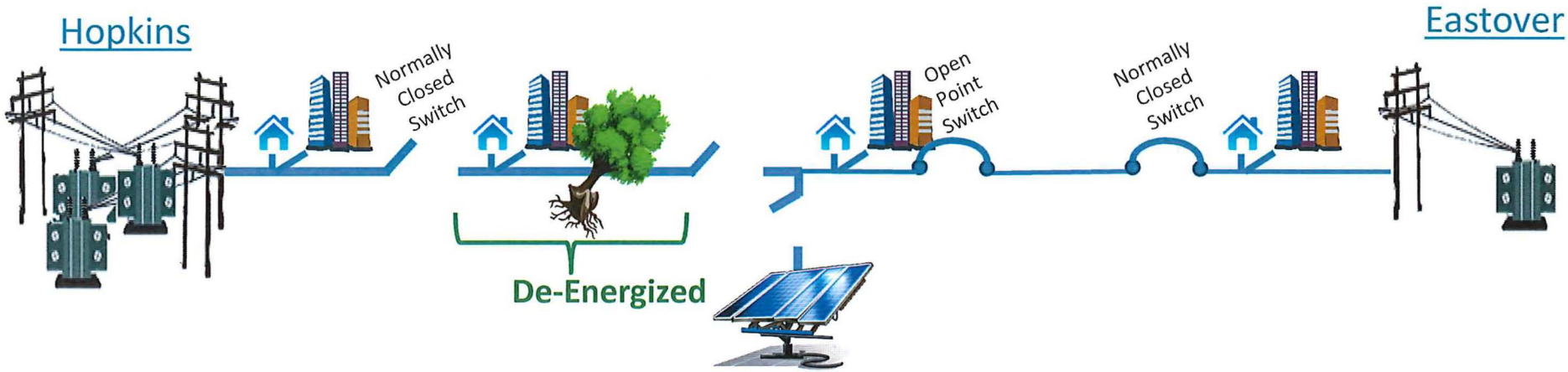
Open switches to isolate the downed power lines where the tree fell

Close the Open Point Switch

Solar Added to the System

To accommodate the solar farm, SCE&G installed larger conductors and upgraded the substation to accommodate reverse power flow.

Operations with Solar



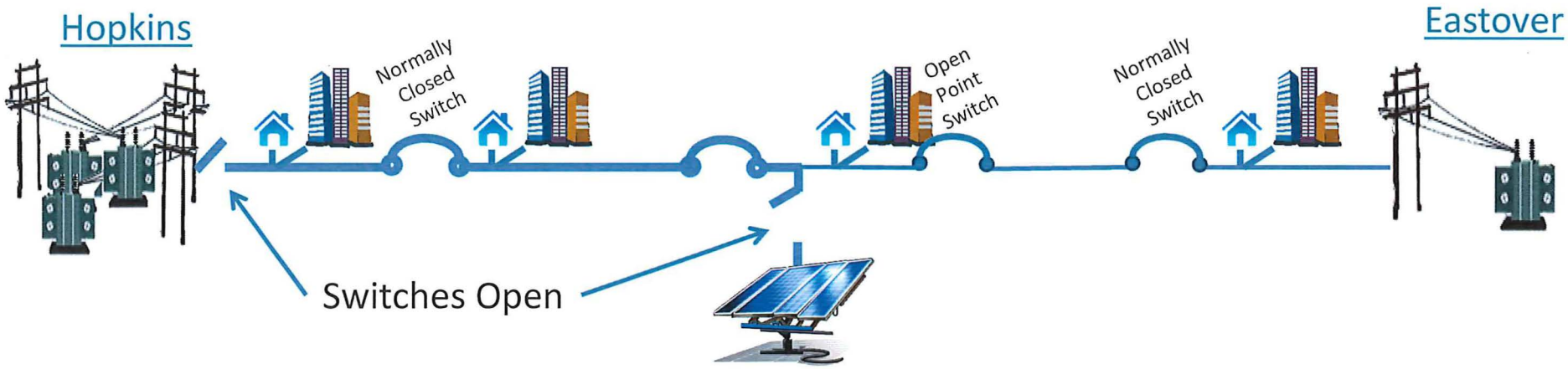
Isolate problem and pick up all possible customers

De-Energize portion where tree fell

Close the Open Point Switch

Solar Farm disconnected

Maintenance Configuration



During maintenance activities, the substation or circuit breaker must be isolated.

Solar Farm must be disconnected

Thank You