DISTRIBUTION SYSTEM CODE TASK FORCE

CHAPTER 6

SUMMARIES OF RECOMMENDATIONS: EMBEDDED GENERATION

TABLE OF CONTENTS

6.1 CONNECTION PROCESS FOR EMBEDDED GENERATORS

[FINALIZED: MARCH 7, 2000]

Issue Statement

Distributors are required to provide new generators non-discriminatory access to their systems. Connection of new generation has technical and cost considerations not present in load connections. The provision of access to distribution systems across Ontario on a more or less consistent basis may not occur without some form of guidelines related to distributors' connections to generators. The issue is:

> Should the Distribution System Code stipulate required protection systems, cost recovery terms, and response times for generation connections to distribution systems?

Options

1. Provide principles for technical and commercial terms for connecting embedded generators.

2. In addition to Option 1, provide guidelines to assist distributors in conforming to principles.

3. Provide prescriptive technical requirements for connections.

4. Provide prescriptive commercial requirements for connections.

Implementation Issues

Appropriate generator equipment and protections are required to protect distributors' equipment and assure safe, reliable energy delivery to others connected to distributors' systems. Equipment and safe guard requirements vary according to location and generator-specific factors, including line loading, alternate line switching configurations, transformer connections, and generator value of connection availability versus capital cost. Many distributors will be required to respond to generator connection requests on a very infrequent basis, and provide a level of response that facilitates access.

Option 1 alone would give distributors maximum flexibility in providing non-discriminatory access to Embedded Generators. Distributors would be challenged to prepare embedded generator connection plans and procedures directly from the principles. Option 2 would provide some assistance in developing plans and procedures. Option 3, prescriptive requirements, would

simplify the process for distributors and provide generators a high degree of certainty with regard to requirements. Undertaking to author and maintain prescriptive technical requirements would require technical resources, and may set up barriers to innovative or cost effective solutions adapted to local circumstances.

Summary of Discussion

Technical requirements are dealt with through documents including the Ontario Electrical Safety Code, Sections 28, 36 and 84, and the IEEE (Institute for Electrical and Electronics Engineers) document *IEEE Guide for Interfacing Dispersed Storage and Generation Facilities with Electric Utility Systems*. Also, good engineering practice can help distributors and generators deal with technical requirements. Prescriptive technical requirements may be most cost effective for relatively small, standard installations (e.g., small photovoltaic, wind and water power generators).

Prescriptive commercial requirements exist and are under development. The IMO Market Rules provide mandatory terms for Connection Agreements, and Performance Based Regulation provides service standards for customer transactions.

Potential guidelines are set out in the appendices to this Summary of Recommendation.

Recommendation

The group recommends Options 1 and 2.

1. Principles to guide technical and commercial terms for connecting Embedded Generators should be included in the Distribution System Code (Option 1). Such principles should include the following:

    - The distributor must respond to new requests for generation connection in a timely and constructive manner.

    - The response must be consistent with established market rules.

2. Generic documentation should be included for guidance as appendix to the DSC or referenced in DSC (Option 2).

    Proposed documentation includes:

    - Appendix A Connection Process – Embedded Generator
    - Appendix B Distributor Contracts Summary – Embedded Generator

- Appendix C Application Form – Embedded Generator Interconnection
- Appendix D Protection Requirements Guide

3. The DSC should encourage development of standard connection technical requirements for relatively small installations (e.g., small photovoltaic, wind, and water power installations). The Electrical Safety Authority, the Canadian Standards Association and equipment manufacturers may have roles in identifying specific installation and equipment requirements.

4. Requirements for commercial arrangements, including contracts, cost recovery policies should be referenced in the DSC. Such references should harmonize, and not overlap, with other legislation that regulates similar commercial arrangements.

Voter Summary

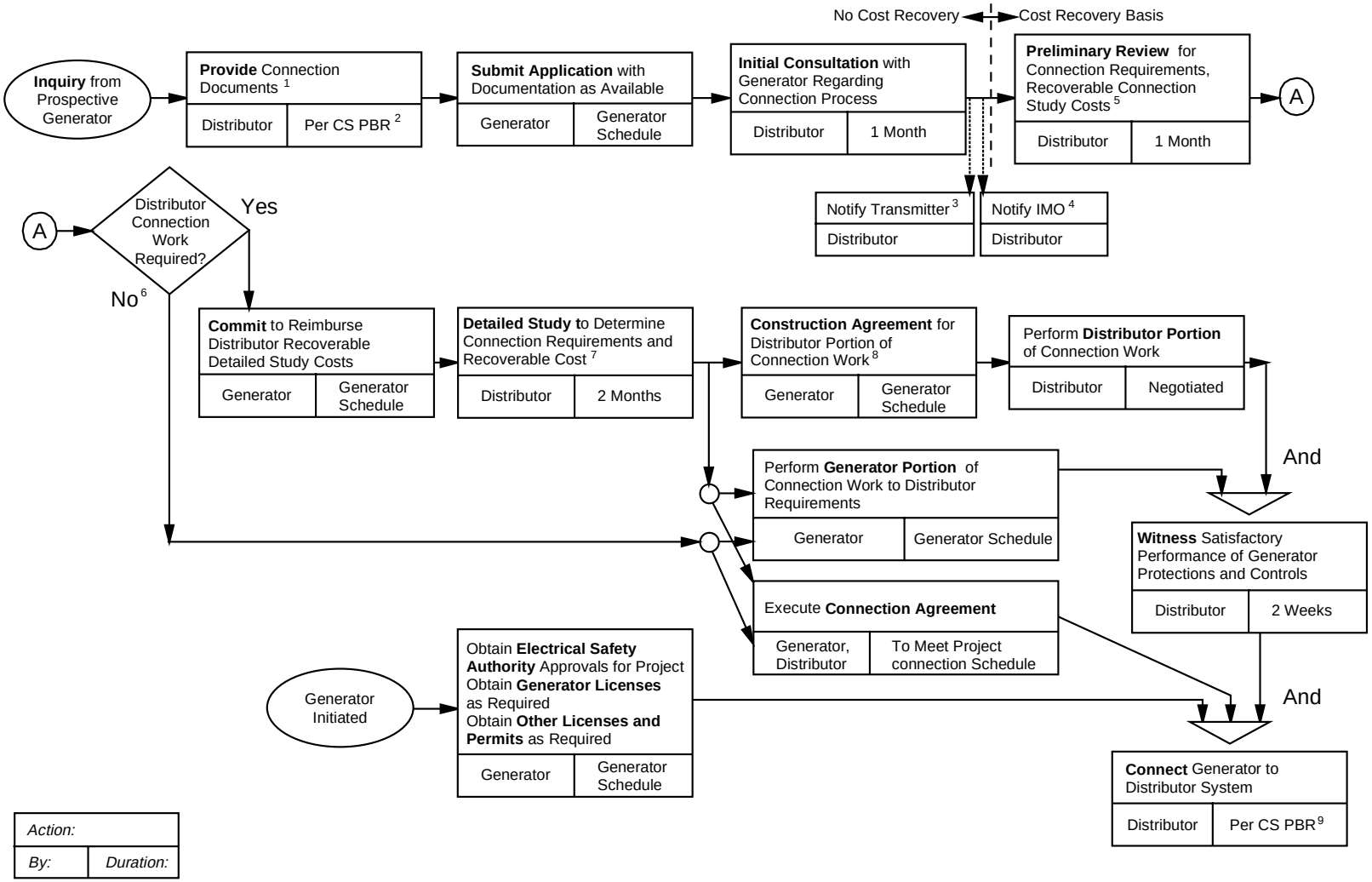
Unanimous.

Dissenting Opinion

None.

Attachments:
Appendix A Connection Process – Embedded Generator
Appendix B Distributor Contracts Summary – Embedded Generator
Appendix C Application Form – Embedded Generator Interconnection
Appendix D Protection Requirements Guide

APPENDIX A
Connection Process Flowchart - Embedded Generator



Footnotes

1. Connection documents include Application to Connect, generic protection requirements, connection process, cost recovery policy, contracts summary.
2. Customer Service Performance Based Regulation for Distributors (within 10 working days 80% of the time).
3. Inform Transmitter in the event that modifications to Transmitter facilities may be required. Subject to applicable Distributor and Transmitter commitments to confidentiality of customer data.
4. Notify IMO in compliance with IMO reporting requirements.
5. Recoverable costs as permitted by regulator.
6. CSA approved standard microgenerator installations, for example.
7. Detailed proposal technical data required from Generator.
8. Distributor work may include work contracted by Distributor to others, including Transmitter and other Distributors.
9. Customer Service Performance Based Regulation for Distributors (<750 V within 5 working days >750 V within 10 working days, after all requirements met, 100% of the time).

Note: Metering requirements are not included in this Process.

APPENDIX B
Distributor Contracts Summary – Embedded Generator

Contract Name	Parties	Purpose
Construction Agreement	Distributor, Generator	Describe obligations of Distributor and Generator to complete connection, cost recovery terms.
Construction Agreement	Distributor, Transmitter	In event Transmitter system requires modifications to connect Generator. Describe obligations of Distributor and Transmitter to complete connection, cost recovery terms.
Customer Account Contract	Distributor, Transmitter	In event EG is a load customer of LDC. Describes terms and applicable rates for firm and backup power, conditions under which backup power is granted and revoked.
Connection Agreement	Distributor, Generator	A technical document identifying common language and procedures to be used for normal and emergency situations, installed protection equipment, ownership and operating control of equipment, expected levels of maintenance and testing by both parties, contact names and telephone numbers, definitions, and containing all necessary schematic diagrams for proper communication between the Distributor and Generator.
Operations Agreement (if required) [1]	Distributor, Transmitter	Modifications as necessary to existing Operations Agreement to include provisions for safe and effective operation in presence of Generator on Distributor system.
Confidentiality Agreements	As required by Distributor, Generator, Transmitter	

Footnotes

1. Additional Operations Agreement(s) or Construction Agreement(s) may be required where other parties are affected by generation connection, e.g., embedded distributors.

APPENDIX C
Application Form – Embedded Generator Interconnection

Date_____

1. Name of Applicant: _____

   Address: _____

   Telephone _____ Fax: _____

2. Project Name: _____

   Project Location: _____

   Project Contact Name & Telephone No:_____

3. Project Consultant(s) Name:_____

   Address: _____

   Telephone _____ Fax: _____

4. Project Type: (e.g. cogeneration, combined cycle, Hydraulic, etc)

5. Construction Schedule:

   Projected Start-Up of Construction _____
   Construction Power Requirement _____
   Site Begins to Generate Power _____
   Projected In-Service Date of EG _____

6. Site Plan with a scaled map referencing the site relative to existing lot lines, easements, road allowances, etc.

7. Preliminary single line diagram showing generator(s), transformer(s) and main isolating devices and proposed electrical connection point to the Distribution system (if known). Include as much information on the electrical protection scheme as is available.

8. Nameplate information on each generator, power transformer and motor in excess of 25% of the generator capacity. Information requirements are listed below.

Generator specifications, including:

- Manufacturer
- Fuel type
- Rated MVA
- Rated MW
- Rated Voltage
- Rated Power Factor
- Inertial constant in kWsec/kVA.
- Maximum MVAR limit
- Neutral ground resistance in Ohms.
- Short circuit unsaturated reactance in per unit on the generator's MVA and kV base:
- Xd – Synchronous reactance in p.u.
- X'd - Direct axis transient reactance in p.u.
- X''d - Direct axis sub-transient reactance in p.u.
- X2 - Negative sequence reactance in p.u.
- X0 - Zero sequence reactance in p.u.

Power Transformer specifications, including:

- Voltages and power rating(s)
- winding configurations
- Specifications of connected neutral reactors or resistors, if installed
- Transformer positive and zero sequence impedances in per unit on the transformer rating base as measured between each pair of windings:
    - R1
    - X1
    - R0
    - X0

Large motor specifications, in order to calculate voltage drops due to motor starting.

- Motor Type (synchronous, induction, etc.)
- Rating in HP or kW
- Power Factor
- Transient Reactance in p.u.
- Sub-transient Reactance in p.u.

9. Expected Monthly Peak and Energy Production and Consumption

Load Displacement Generators and Merchant/Load Displacement Generators (generator supplies on-site electrical loads not directly related to operation of generation equipment)

	Generator Output		**Site Sales**		**Site Purchases**	
	kWh	**Peak kW**	**kWh**	**Peak kW**	**kWh**	**Peak kW**
January						
February						
March						
April						
May						
June						
July						
August						
September						
October						
November						
December						

10. Future site development plans.

11. Provide a brief description of the proposed plant design and operating characteristics and technical personnel to be employed by the generating facility.

Upon completion of this application form, please return to Distributor for their review and concurrence to proceed.

AUTHORIZATION:

I request “Distributor” to proceed with a preliminary review of this embedded generation interconnection application and I agree to pay the cost associated with completing this review.

I further consent to “Distributor” providing this information to the Independent Market Operator, the Transmission Company, and other Distributors as required.

_____	_____
Name: (Please print)	Signature:
_____	_____
Date:	Title:

APPENDIX D
Protection Requirements Guide
Connection of Embedded Generator Stations (EG) to Distributor Systems

1.0 Disclaimer

This guide is not intended to take the place of design and review of a proposed embedded generator station (EG) installation by a competent person. Such design and review should include consideration of proposed power and protective equipment, and local conditions, including existing and future equipment, loading, and operating conditions.

2.0 Introduction

This guide outlines typical protection requirements for connecting an EG to a Distributor system to ensure safe and reliable Distributor system operation. The guide focuses on protections required to detect and isolate the EG from the Distributor system when faults/disturbances occur on the Distributor system, to protect the Distributor system and other users of the Distributor system. The EG should consider these typical requirements when preparing the proposed protection package for Distributor's review. Normally, the protection features are required by the Distributor at the interface point. However, some protection features may be included in the generator protection package.

The EG must provide protection systems to cover the following conditions:

(1) Internal faults, i.e., provide adequate protections to detect and isolate generator and station faults. (Details are not covered in this guide).

(2) External faults i.e., Local Distribution System or interconnected transmission system phase faults/ground faults.

(3) Islanding/Abnormal Conditions.

(4) Additional Protection Features such as Remote Trip and Generator end open signal may be required in some applications.

This guide will cover protections requirements associated with items 2, 3 and 4.

3.0 External Faults

The protection system must be designed to provide full feeder coverage complete with a reliable DC supply. In some cases, redundancy in protection schemes may be required.

Normally the following fault detection devices are required for synchronous generator(s) installation(s). (For protection of induction generator - see brief write up later in this document).

3.1 Ground Faults

When the HV winding of the EG station transformer is wye connected with the neutral solidly grounded, then ground overcurrent (64) protection in the neutral is required to detect ground faults.

If the EG station transformer HV winding connected to the Distributor system is ungrounded wye or delta, then ground undervoltage 64-27 and ground overvoltage 64-59 protections are required to detect ground faults.

Depending on the size, type of generator and point of connection, Distributor may require the relaying system to be duplicated, complete with separate auxiliary trip relays and separately fused DC supplies to ensure reliable protection operation and successful isolation of the EG.

3.2 Phase Faults

To detect phase faults, at least one of the following protections must be installed with acceptable redundancy where required depending on fault values:

- distance (21)
- phase directional overcurrent (67)
- voltage-restrained overcurrent (51V)
- overcurrent (51)
- undervoltage (27)

Example:

To provide reliable phase fault protection and successful isolation of fault current from the EG station 21 feature (set to cover 125 percent of the longest connected feeder) timed at (1.0 s) will normally be acceptable together with generator voltage/frequency protections as back-up.

4.0 Islanding/Abnormal Condition

Voltage and frequency protections are required to separate the EG from the Distributor system for an islanded condition and thus maintain the quality of supply to Distributor customers. This will also enable speedy restoration of the Distributor system.

Normally, the protections required to detect islanding/abnormal conditions are:

- overvoltage (59)
- undervoltage (27)
- overfrequency (81O)
- underfrequency (81U)
- voltage balance (60)

The above protections will be timed to allow them to ride through minor disturbances.

4.1 Induction Generator

Due to the operating characteristics of the induction generator the protection package required is normally less complex than the synchronous generator. It should be noted that EG must design the protection scheme to trip for the same conditions as stated for synchronous generators.

An induction generator is an asychronous machine that requires an external source (i.e., healthy Distributor system to produce normal 60 hz power). Alternatively, if there is an outage in the Distributor system then there is unlikely to be 60 hz output from the induction generator. In certain instances, an induction generator may continue to generate electric power after the source is removed. This phenomenon, known as self excitation, can occur whenever there is sufficient capacitance in parallel with the induction generator to provide the necessary excitation and when the connected load has certain resistive characteristics.

5.0 DC Remote Tripping/Transfer Tripping Between EG and Feeder Circuit Breaker

Remote or transfer tripping may be required between the EG and the feeder circuit breaker because the EG is connected at a critical location in the Distributor system. This feature will provide for isolation of the EG when certain faults or system disturbances are detected at the feeder circuit breaker location. The use of this feature may be restricted by physical limitations or economics.

Footnotes

1. The EG is responsible for providing suitable EG equipment to protect his plant and equipment for any conditions on the Distributor and interconnected transmission systems such as reclosing, faults and voltage unbalance.

2. To incorporate the connection of EG to the Distributor system, the line/feeder protection including settings and breaker reclosing circuits must be reviewed and modified if necessary by the Distributor or transmission authority. This process may be complex and may require significant time.

3. The EG must submit a proposed single line diagram and protections for review to the Distributor contact as identified by the Distributor.

4. Based on the transformer connection proposed by EG additional significant protection cost may be incurred (e.g. delta HV transformer winding may require 3 phase HV breaker/recloser device). The EG should not order the protection equipment and transformer until the station line diagram is reviewed and accepted by the Distributor.

5. The purpose of the Distributor review is to establish that the EG electrical interface design meets the Distributor requirements.

6. The protection schemes should incorporate adequate facilities for testing/maintenance.

7. Negative phase sequence (46) protection may be desirable for some applications to detect abnormal system condition as well as to protect the generator.

8. The EG may be required to install utility grade relays for those protections which could affect the Distributor or transmission authority system.

9. The EG may be required to submit a Ground Potential Rise study for review by the Distributor, if telecommunications circuits are specified for remote transfer trip protection.

6.2 COST RECOVERY OF GENERATOR CONNECTION TECHNICAL REVIEW AND ANALYSIS AND CONNECTION COST ESTIMATES

[FINALIZED: DECEMBER 22, 1999]

Issue Statement

Unlike standard connections for consumers of energy, connection of an embedded generator to a distributor's distribution system requires a distributor to review and analyze the impacts of the proposed facility on its system and to estimate the connection costs for the proposed facility. Due to varying complexities, technical requirements and costs associated with the review and approval of an embedded generator, the costs of these functions and connections are unique in each case. As a result, it is necessary to recommend a method of compensating the distributor for the time and effort spent reviewing, analyzing and estimating the connection costs for the proposed facility.

Depending on the size and complexity of the proposed generation facility, the distributor's costs of connection can impact the economic feasibility of the generator's business case. Subsequently, the generator may choose not to proceed with the project, leaving the distributor with no way collecting the engineering/analysis/estimating costs. The issue is:

> How should a distributor collect the costs reasonably incurred to make an offer to connect an embedded generator?

Options

1. Collect the costs through inclusion in the costs of service for the customer class.

2. Collect the costs through the cost of service for all customer classes.

3. Collect the costs directly from the applicant (i.e., generator).

Implementation Issues

Recovery of a distributor's costs begins to overlap with rates. However, this is a special type of cost that can be linked to a specific distribution customer. In implementing cost recovery rules, it is important to ensure that rules are non-discriminatory and do not conflict with open access.

Summary of Discussion

Option 1 would require a definition of a new customer class for generators. This alone is not a

difficult task, but there will be at least three sub-classes needed to distinguish between a wholesale generator, a load displacement generator with no reserve (back-up) capacity required, and a load displacement generator with reserve capacity requirements. The cost of the review, analysis and connection cost estimation process will be different for each generator type. This need for sub-classes will increase regulatory burdens on both the distributors and the OEB.

Also, the generator's cost of making an application to the distributor, and eventually deciding that the project is not feasible, would increase the costs of service for all other generators in the same class.

Many of the same arguments offered in Option 1 are applicable to Option 2. The subsidization of the generator at the expense of residential and commercial customer classes is very likely more contentious than any unrest created among other generators in Option 1.

Option 3 effectively would force generators to pay for the costs of filing and processing an application, analyzing and estimating connection costs. There would not be any impacts on the costs of service for other customer classes or others in the same class. The size and complexity of a proposed project will determine the costs of review, and if the project is found to be unfeasible, the distributor will be compensated for its costs. This option meets the non-discriminatory access requirement of the Electricity Act, since it offers the same published process for all generator applicants.

The group recognizes that these issues may be addressed by the transmission hearing.

Recommendation

Option 3 is the recommended approach to distributor cost recovery for all detailed review, analysis and connection cost estimation for a generator's connection application. Costs should be collected directly from the applicant (i.e., generator) prior to starting the review process.

Voter Summary

Unanimous.

Dissenting Opinion

None.

6.3 REQUIREMENTS FOR AN OFFER TO CONNECT AN EMBEDDED GENERATOR

[FINALIZED: MARCH 30, 2000]

Issue Statement

Connection to an embedded generator includes costs associated with new connection installations and possibly expansion of an existing distributor's distribution system. The issues are:

How should a distribution utility evaluate the economics and financing of distribution system expansion and enhancement projects required to connect an embedded generator?

What level of capital contribution should be required for this work?

What part of the work, if any, should be contestable?

Options

1. Allow each distributor to have complete freedom and autonomy to formulate its own policy with respect to the economics and financing of distribution system expansion and enhancement projects required to connect an embedded generator.

2. Develop a set of guiding principles and steps for economic project evaluation as it relates to embedded generation. These guiding principles will be included in the Distribution System Code.

3. Develop a detailed approach that prescribes the principles and implementation details, for economic project evaluation including determination of capital contribution amounts. These principles and implementation details will be included in the Distribution System Code.

Implementation Issues

Many of the implementation issues already have been addressed in the summary of recommendation on principles for an offer to connect a building that does not lie along a distributor's distribution system. With respect to embedded generators, a key implementation issue is what distributor charges, if any, an embedded generator will be required to pay.

Summary of Discussion

One of the main principles distributors must follow is that there be nondiscriminatory access to the distributor's distribution system for all prospective embedded generators. As a result, the method and application of determining whether an embedded generator can connect and at what cost, should be fair and open.

When an embedded generator wishes to be connected to a distributor's system, there will be work required by the distributor on its system. The group felt that the model proposed in the Summary of Recommendation, Economic Evaluation Model for Distribution System Expansion was an appropriate tool for utilities to determine if a project related to an embedded generator was feasible. In contrast to load customers, a distributor does not normally receive revenue from an embedded generator. However, this may change if wheeling rates are implemented.

With respect to the issue of avoided costs for the distributor as a result of an embedded generator coming on line, it was felt that these should not be considered in the economic analysis because the Distributor still had to provide backup if the embedded generator failed.

Recommendation

Option 3 is recommended. The following principles and implementation details should be prescribed in the Distribution System Code:

1. A distributor shall be required to perform an economic evaluation of distribution system projects required to connect an embedded generator, to determine economic viability of the project.

2. A distributor shall develop its own Discounted Cash Flow (DCF) Model for economic evaluation, based on the principal of Net Present Value (NPV).

3. In all cases, the revenue from the embedded generator is to be assumed to be zero unless dictated otherwise by rates.

4. No allowance will be made for the potential avoided cost of not having to build distribution facilities as a result of the embedded generator coming on line.

5. A distributor may ask the embedded generator to pay a capital contribution up to the amount that would result in a NPV equal to zero.

6. The SOR on Contestability for Expansion will also apply for work required to connect an embedded generator.

Voter Summary

Unanimous.

Dissenting Opinions

None.

6.4 APPROVAL REQUIREMENTS OF A DISTRIBUTOR PRIOR TO CONNECTION OF AN EMBEDDED GENERATOR

[FINALIZED: NOVEMBER 10, 1999]

Issue Statement

Connection of an embedded generator to a distribution system may require a variety of approvals and inspections before the connection should be made. The issues are:

> What are a distributor responsibilities in relation to ensuring that an embedded generator has secured the necessary approvals prior to the distributor connecting the embedded generator to the distributor's distribution system?
>
> Specifically, should the distributor ensure that the embedded generator has secured approval from the Electrical Safety Authority and the Ministry of the Environment for any required Environmental Assessments?

This discussion does not apply to Temporary Construction Power.

Options

The options available are any combination of the following:

1. Requirement for proof of approval from Electrical Safety Authority.
2. A signed Connection Agreement with the distributor.
3. Proof of approval under the Environmental Assessment Act
4. Review of a Ground Potential Rise Study performed by a competent individual.
5. Protection coordination review.
6. Proof of a generator s licence, if the generator proposes to sell electricity or settle through the distributor's settlement system.
7. A valid Participation Agreement with the IMO.

Implementation Issues

There should be no significant implementation issues since distributors have experience in connecting generators to their distribution systems.

Summary of Discussion

A distributor is required to connect embedded generators (generators) to the distributor's distribution system. Before a generator is connected, the distributor has the right to ensure the connection will not cause problems on the distribution system for other customers or significantly reduce the reliability of supply to other customers.

In the case of a load customer, the distributor requires proof that the customer's equipment has passed electrical inspection prior to connection to ensure the new electrical facilities are safe. This requirement should apply to generators as well.

For larger customers, distributors generally enter into Connection Agreements prior to connection to ensure safe operation of the facilities to employees and the public. A similar requirement should apply to generators as well.

Generators have complex protection requirements. Prior to the connection of a generator, a thorough review of the protection scheme is required to ensure that the protection is adequate and will not adversely affect the reliability or safe operation of the distribution system. In addition, a functional test of the protection must be carried out to ensure that the protection operates correctly.

For larger customers, a Ground Potential Rise study may be required to ensure the new electrical facilities do not present a safety hazard or adversely affect telecom and protection facilities (Reference the Electrical Inspection Act (1998) – Section 36-304). Distributors require assurance that the need has been reviewed and, if a Ground Potential Rise study is required, a competent person has performed it. A similar requirement should apply to generators as well.

The regulation of construction of a customer's facility, as well as the ongoing operation, is the responsibility of the appropriate regulating body. In the case of the generator, a similar requirement should apply. In particular, any required Environmental Assessments should be policed by the appropriate regulating body. This requirement could be part of the Generator licensing process.

To assist the OEB with licensing, a distributor could advise the OEB of any contacts made by generators for connection. As an alternative to this approach, the distributor could require a copy of the generators licence before final connection. The OEB could ensure the generator receives all approvals before issuing the licence. However, the generator most likely will be connected as a load customer before the facility is capable of generating, and may not have or need a generator's licence at that time a connection is requested.

A participation agreement with the IMO is required to participate in the wholesale market. The wholesale market status is not a concern to the distributor and therefore should not be a required piece of information before connection of the generator.

Recommendation

Before a distributor connects a new generator:

1. Proof should be supplied to the distributor that the generator's facility has received approval from the Electrical Safety Authority.

2. The distributor and the generator should have agreed to a Connection Agreement.

3. There should be proof that a competent person has performed a GPR study, if required.

4. A protection coordination review and functional test of the protection should have been performed.

5. Proof of a generator's licence from the OEB should be supplied.

Voter Summary

Unanimous.

Dissenting Opinions

None.

6.5 SUGGESTED PRINCIPLES FOR DISTRIBUTORS WHEN CONNECTING A GENERATOR TO A DISTRIBUTION SYSTEM

[FINALIZED: DECEMBER 22, 1999]

Issue Statement

Many distributors in the province do not have embedded generators in their systems. However, as a result of the licensing requirement of non-discriminatory access to generation, all distributors will be required to offer to connect embedded generators to their systems.
When a generator approaches a distributor for connection to the distribution system, it would be helpful for the smaller distributor to have some general guiding principles to assist with the response to the request. This issue is:

> What guidelines should the Distribution System Code provide for distributors when offering generators connections to their systems?

Options

1. Allow each distributor to formulate its own process and guidelines for dealing with the generator's request and allow the distributor complete freedom to deal with each request in whatever manner it chooses.

2. Suggest a set of general processes and principles, but allow each distributor to choose whether to follow these processes and principles, modify them, or ignore them as is seen fit.

3. Mandate some general guiding principles and processes to ensure that every distributor in the province responds in a consistent manner, regardless of their experience with generator connection requests. Also, write these guiding principles and processes into the appropriate sections of the Distribution System Code relating to Embedded Generation Connections.

Implementation Issues

Option 1 is not consistent with the OEB's expectation of standardization of distributors' activities whenever possible. Option 1 also would allow the distributor familiar with generation connection requests to bias their processes toward one size or type of technology. This ability to introduce bias would not ensure non-discriminatory access, as is required by the conditions of the Transitional Distributor Licence. The OEB would not have control over the actions of the distributors.

Option 2 is a step toward standardization, but likely not far enough to meet the requirement of non-discriminatory access for generation connections and would not give the OEB the necessary control over the actions of distributors with regard to embedded generator connections.

Option 3 will ensure that distributors across the province deal with and respond to generators' connection requests in consistent manners, regardless of project sizes or distributors' past experiences.

Summary of Discussion

If Option 3 is adopted, a set of standard processes and principles needs to be developed. The subgroup on Embedded Generation offered the following as a possible set of guiding principles for dealing with requests for Embedded Generation Connection:

As a distributor in the Province of Ontario, the distributor shall ensure that:

1. Employees and the public are safe.

2. Reliability of the distribution system is not negatively impacted by the connection of a generator to the system.

3. Non-discriminatory access policies and procedures are in place when dealing with requests for embedded generator connection.

4. The distributor's distribution system is adequately protected from damage.

5. The distributor be reimbursed for any additional operating costs resulting from a generator connection to the system, thereby minimizing any impact on the costs of service for other system customers.

6. Respond to new generation connection requests in a timely and constructive manner in accordance with good utility practice.

Recommendation

Option 3 is recommended. The DSC should mandate some general guiding principles and processes to ensure that every distributor in the province responds in a consistent manner, regardless of their experience with generator connection requests.

The six suggested guiding principles should be incorporated in to the DSC in sections that deal with generator connections.

Voter Summary

Unaninous.

Dissenting Opinion

None.

6.6 MAINTENANCE GUIDELINES FOR EMBEDDED GENERATION CONNECTIONS

[FINALIZED: DECEMBER 22, 1999]

Issue Statement

Embedded generation can have a significant impact on the distribution system. As a result, the maintenance of the embedded generator as it relates to its connection to the distribution system is of concern to the distributor. In a separate SOR, it was recommended that a distributor must have a Connection Agreement with the Embedded Generator. The issue is:

> To what extent should maintenance requirements by the embedded generator be included in the Connection Agreement?

Options

1. Provide no guidelines with respect to maintenance expectations from generators.

2. Require that distributors address maintenance requirements in their Connection Agreements, but do not specify those requirements. Instead, provide guidelines that Distributors should consider when writing maintenance requirements into their Connection Agreements.

3. Provide prescriptive maintenance requirements for generators that will become requirements in the DSC.

Implementation Issues

Option 1 provides no guidance for the inexperienced distributor. Members of the group believed that from the generator's point of view, they would expect a distributor to be reasonably informed and have a list of expectations and requirements before entering into a Connection Agreement.

Option 2 strikes a balance between advising distributors and establishing equal expectations for maintenance across the province. The group believes that advising and setting expectations will contribute to equal, non-biased access for all generators, regardless of their locations.

Option 3, which requires prescribed maintenance requirements that will become part of the DSC, was rejected based on the following considerations:

1. Additional requirements may duplicate those set out by the IMO, which is particularly true if the generator wishes to be a wholesale market participant.

2. For generation capacity greater than 10 MW, the IMO may make compliance to NERC rules mandatory, which would result in duplication of requirements.

3. The technology used to generate electricity, especially plants with capacity below 10 MW, can take many forms, including wind, solar, gas, diesel, etc. The subgroup felt that prescriptive rules governing all these various energy sources was beyond the scope of this committee and would be very difficult to author and maintain.

4. Circumstances under which generation is installed and used can vary considerably. The committee felt that a guideline, as opposed to a requirement, would be more appropriate to allow distributors and generators options to devise their own mutually beneficial maintenance requirements.

Recommendation

Option 2 is recommended. The following guidelines for maintenance requirements should be included in the DSC:

Each distributor that has a generator connected to its system shall arrange with the owner/operator of the generator to establish a maintenance plan that covers those parts of the embedded generation that could impact the distribution system adversely. A maintenance plan shall be included as part of the Connection Agreement signed by both the distributor and the generator.

The following are general guidelines that should be considered when the distributor and generator's owner/operator are developing a maintenance plan:

1. Protection systems should be tested at intervals of no more than 4 years, if microprocessor based, and every 2 years (2:1 ratio) if electro-mechanical based protection is used. The test must prove that the system operates properly and within specified time limits under various input situations (both current and voltage) and that all isolating switches and breakers operate as designed.

2. All isolating devices at the point of connection (i.e., switches and breakers) should be operated at least once per year. The owner/operator of the generation station can perform this test as part of a more general maintenance inspection.

3. The generation facility, as it affects the distribution system, should be visually inspected at least once per year to note obvious maintenance problems such as broken insulators or other damaged equipment.

4. Only qualified personnel should carry out inspections and repairs.

5. All deficiencies should be noted and repairs should be scheduled as quickly as possible. The distributor should be notified of any deficiencies involving critical protective equipment (a list of which could be established in the Connection Agreement).

6. The time to repair a deficiency should be dependent on the severity of the problem, due diligence efforts by both the distributor and the generator, and financial and material requirements. In all cases repairs, should be completed as quickly as possible.

7. The distributor may choose to receive copies of all relevant inspection and repair reports. Reports should be submitted no more than 30 days after inspections or repairs are completed. As a general rule, only systems that may directly impact the protection and performance of the distribution system are of interest to the distributor. A list of systems for which copies of inspection reports are required could be agreed upon and included in the Connection Agreement. At the distributor's discretion, the generator should provide access to witnesses when any relevant tests are being performed. Witness testing may substitute for printed reports.

8. Requirements for arrangements of isolation of the generator for maintenance purposes should be specified as a general policy of the distributor or detailed in the Connection Agreement.

Voter Summary

Unanimous.

Dissenting Opinions

None.