Ontario Power Authority
Toronto, Ontario

Northern York Region Electricity Supply Study
Submission to the Ontario Energy Board
September 30, 2005

Exhibit F
Transformation & Distribution Options
Northern York Region

Hatch Acres
September 26, 2005

Table of Contents

1 TRANSFORMATION AND DISTRIBUTION PLANNING

1.1 Planning Principles

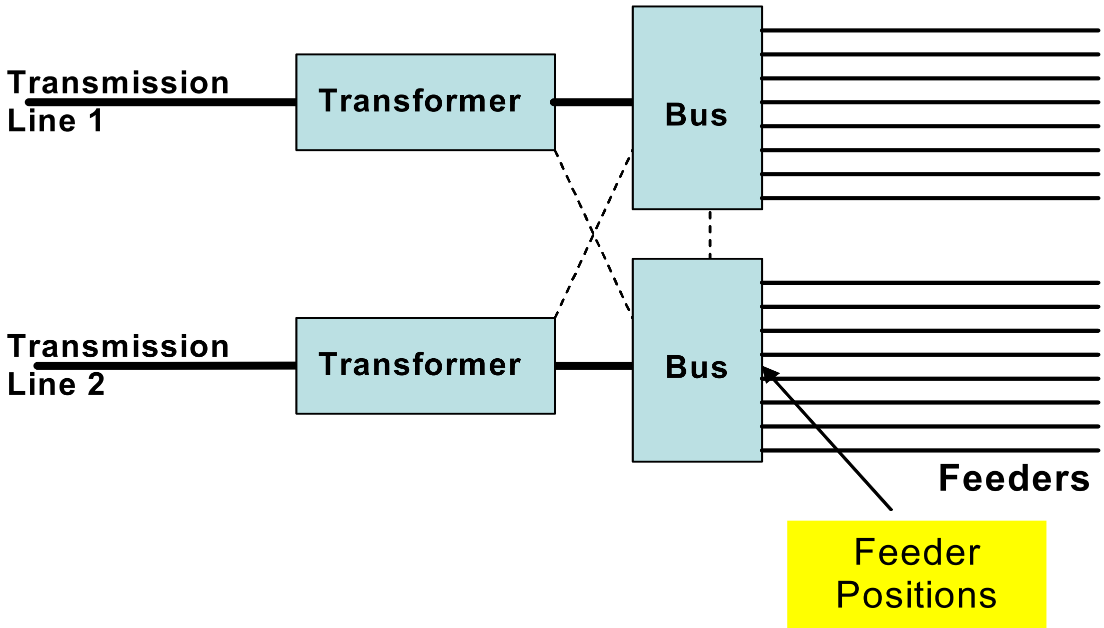
Transformation and Distribution planning principles in use in Ontario are unique to Ontario and have evolved over many decades.

Distribution and transformation have been grouped together because both bottlenecks are related and must be addressed jointly, typically by the same remedy, a new transformer station. The location of the TS is critical for a number of reasons. Firstly, it should be central to the loads it serves to minimize the losses along feeder lines as well as the cost of running those feeders. Secondly, there must be an adequate supply of high voltage power to a transformer station to ensure it can run to its capacity.

1.1.1 The DESN Station

The Dual Element Spot Network (DESN) transformer station is at the heart of the planning philosophy. Approximately 260 DESN transformer stations are in use in Ontario today. These stations take power from high voltage transmission lines at either 115kV or 230kV and step it down using transformers to supply approximately eight outgoing low voltage feeders emanating from the station. These low voltage feeders are usually 13.8kV, 28kV or 44kV pole lines that carry power along roadways to supply communities with power.

"Dual Element Spot Network" or DESN is a concept that provides redundancy in the form of duplication for most station components. There are two incoming transmission lines, two transformers and two low voltages busses. Any of these components can fail without seriously affecting supply reliability, as the companion equipment is capable of carrying the total station load. The structure of a DESN station is shown below. The dotted lines indicate that either incoming transmission line and companion transformer can supply either low voltage bus.



Although not shown on the above diagram each of the outgoing low voltage feeders can be supplied from either of the two low voltage busses.

The capacity of a DESN station is determined by the "Limited Time Rating" (LTR) of one of the two transformers. This is based on the assumption that one line or transformer could be forced out of service at any time leaving the remaining transformer to carry all of the load. These ratings are very aggressive and when used stress the transformer to the point where its life will be shortened but it will not fail in the short term. For example a typical transformer with a 75 megavolt ampere rating can be used to carry 125 megavolt amperes continuously if cooling fans and oil circulating pumps are used and 167 megavolt amperes(about 150 megawatts) for up to ten days in an emergency. Even higher loads can be carried for short periods so a two hour rating is often provided. The ten day LTR is the overload rating acceptable for a transformer to cater to the assumed ten day repair period for its companion transformer. The two hour LTR rating is to provide a long enough time of acceptable overloading to permit load to be shifted to other stations should that be possible, or to set up rotational load shedding if that is the only option. The "station rating", typically about 150 megawatts is based on the ten day LTR.

The following photo shows Armitage TS. It is a "Double DESN" with a pair of stations on the same piece of property. The two pairs of transformers and associated low voltage bus work can be clearly seen. The low voltage feeders leave the station on short underground cables and overhead pole lines shown at the left of the picture.

Armitage TS

1.1.2 The Distribution Network

There are two variations of distribution networks in use in Ontario, one in urban areas and the other in rural areas.

The distribution network in rural areas is the most straightforward as it is simply a radial network of feeders with each independently supplying a pocket of load ranging from about 15 to 22 megawatts. There is no redundancy in rural areas and should the supply station experience a catastrophic failure, or if the radial feeder fails for any reason, customers will be without power. This risk is acceptable because repairs to wood pole lines can usually be completed within hours and total station failures are rare.

The distribution network in urban areas is generally designed so that different feeders from the same station or from adjacent stations can be interconnected. This is possible because of the close proximity of other feeders and other stations in built up areas. This arrangement allows load to be moved between feeders or between stations should overloading situations arise.

The primary function of low voltage feeders is to deliver power to areas where new development is taking place and to meet load growth requirements where existing load is growing. It is quite possible that even in an area where aggregate load is remaining constant or declining there will be a requirement to build feeders to supply load growth areas.

1.1.3 Requirements for Meeting Demand

Transformer stations and associated feeders are provided to meet "local" supply requirements. Local needs are very specific and appear as a new shopping plaza or industry in a specific location that requires a specific supply infrastructure. Feeders in particular carry power to specific locations and whether the total capacity a feeder is required or not a feeder must be built. This is similar to providing a highway to a community that may never be used to full capacity but is none-the –less required. Because of the requirement to provide service, it is rarely possible to fully load all transformation and distribution infrastructure. This inherent lack of "portability" of transformation and distribution capacity means that decisions to provide new transformer stations or feeders are more complex than just adding up megawatts.

The more common demands that must be satisfied are as follows:

New Customers Requiring Service – New customers such as an industry or a subdivision, will require either and extension of a feeder or a new feeder depending on the magnitude of the new load and the available capacity of nearby feeders. They will also require transformation capacity to serve their new load and that will either consume existing available capacity or trigger a requirement for a new transformer station. New customers are generally in the "growth areas" of a community, and the requirement to service those new areas is fairly obvious.

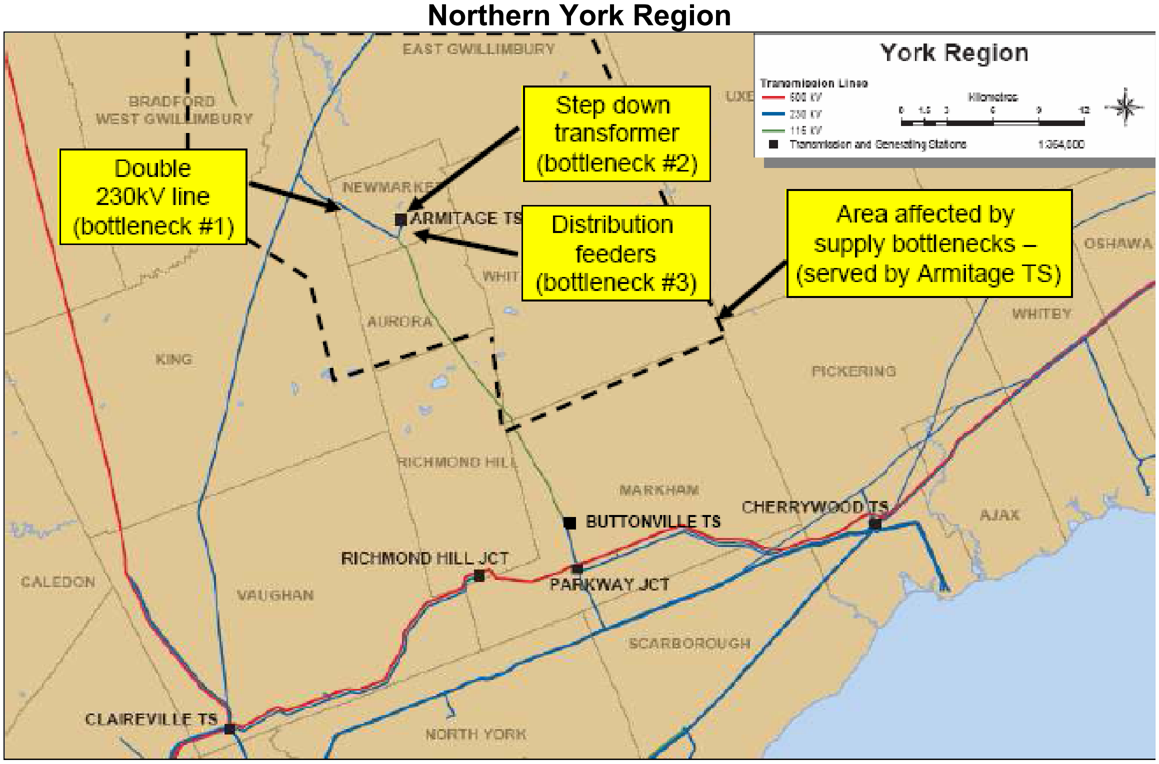
Growing Demand – Growing demand occurs in already built up areas of a community and usually takes the form of larger replacement housing, infill where land was not previously occupied, replacement of existing commercial buildings with larger multi story ones and the integration of new uses of electricity such as central air conditioners. Growing demand should be offset to some extent by provincial and other Conservation and Demand Management Programs (CDM). For demand that is not offset it may be necessary to provide new or reinforced feeders to meet the local demand, and to make available new or unused transformer capacity.

Substandard Reliability – Substandard reliability can arise if the specific feeder supplying a customer is too long, thereby increasing the customer's exposure to feeder outages. It can also be a result of inadequate transformer capacity and the resulting loss of supply redundancy. If there is inadequate transformer capacity, one of the two supply transformers will not be able to carry the entire station load. Accordingly load will have to be shed in the form of local rotating blackouts should one transformer fail. The solutions to this type of reliability problems are generally an additional feeder to split the existing customers over two shorter feeders, or to provide an additional transformer station should transformer capacity be the issue.

Substandard Power Quality – Reliability is usually thought of as the presence or absence of power. Power Quality is a measure of the integrity of the power when it is available and includes the customer's receipt of correct voltage, voltage dips, and corrupted AC waveforms because of neighboring industrial processes. The most common problem is low voltage at the ends of long overloaded feeders. The solution is generally to provide another feeder to share the load. Although the solution to power quality problems may not require new transformer capacity it may require the addition of a feeder position at the supply station.

2 TRANSFORMATION AND DISTRIBUTION IN YORK REGION

Northern York Region



Northern York Region is a very unusual supply island with only one pair of incoming 230kV high voltage circuits and one transformer station, Armitage TS located in Newmarket.

2.1 General Characteristics of the Supply

Three characteristics make this island unusual.

- The first is that the geographic area supplied by the two lines and associated transformer station is very large. The Armitage TS supply area extends from Bradford West Guillimbury in the west to beyond Whitchurch-Stouffville in the east. It includes the large and the growing communities of Aurora and Newmarket among many others.

- The second unusual aspect is that this is a 44kV distribution area. In Ontario 28kV is generally used in built up areas and 44kV is used in rural and sparsely populated areas. Northern York Region was initially rural but as it became more urban the communities were forced to retain the 44kV system as it was the only supply available. The consequence of this is that the Armitage TS distribution voltage is incompatible with the stations to the south in York Region and load cannot be transferred back and forth. One station within reach for load transfers and having the same 44kV voltage, Brown Hill TS is supplied by the same heavily loaded lines that supply Northern York Region and cannot provide significant support. The second, Kleinberg TS is heavily loaded and a long distance away.

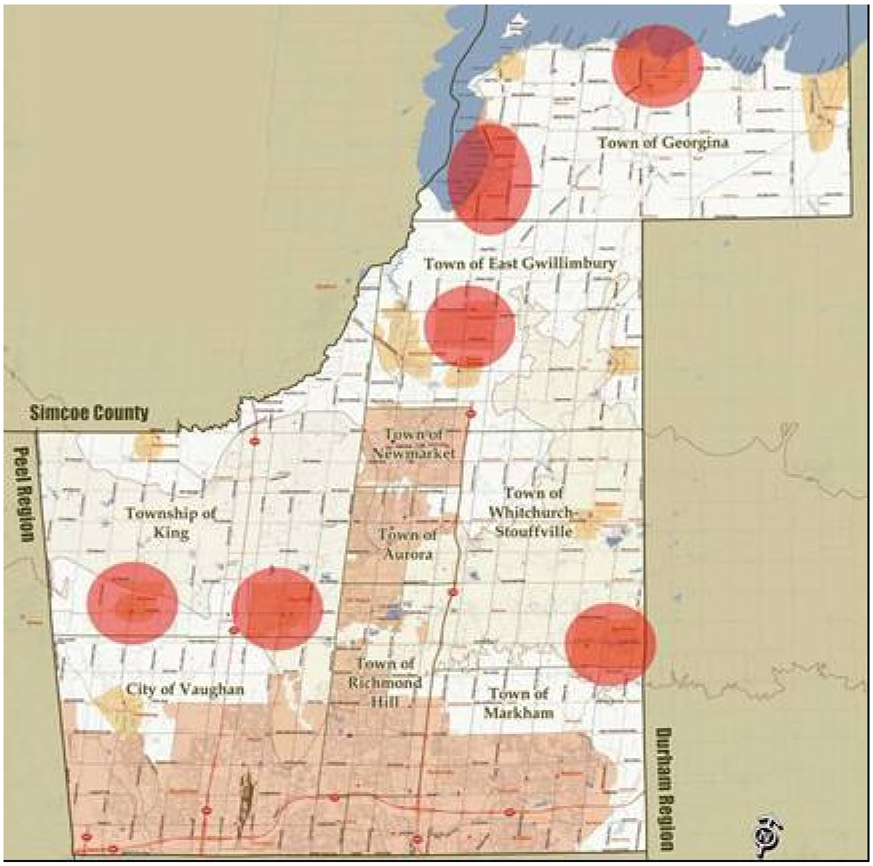
- The third unusual aspect is the very large size of load that is supplied by this rudimentary infrastructure, and the lack of diversity of supply. The peak load is approaching 500 megawatts and should something go wrong such as the loss of the incoming transmission line in a tornado, or a fire at the Armitage transformer station the consequences would be very far reaching. There is little possibility of providing much relief during such an event as no alternatives are available even in emergencies for most of the load. This is the result of a lack of "diversity" in the supply.

Armitage TS has been loaded above planned transformation capacity since 2002. Additionally, because feeder egress from the station is highly congested it has not been possible to build new feeders from the station. As a result there is a backlog and resulting compromises in customer supply. Should a pair of transformers be forced out of service because of the forced outage of an incoming line, or for other reasons during peak load times, it may be necessary to commence rotational load shedding (rotating local blackouts) to protect the remaining transformers from damage due to overloading. Almost no ability to move Armitage TS loads to other transformer stations exists because the practical possibilities have been exhausted.

2.2 Load growth areas in Northern York Region

The following diagram indicates the areas of load growth in northern York Region. These areas are in addition to growth in Newmarket and Aurora. This growth will require new

44kV feeders and transformer capacity to meet the need in those specific areas. A detailed analysis shows the need to be north and southeast of Newmarket. The growth areas in Vaughn in the south west are outside the study area. Whitchurch Stouffville to the south east is inside the study zone as it is supplied by Armitage TS.

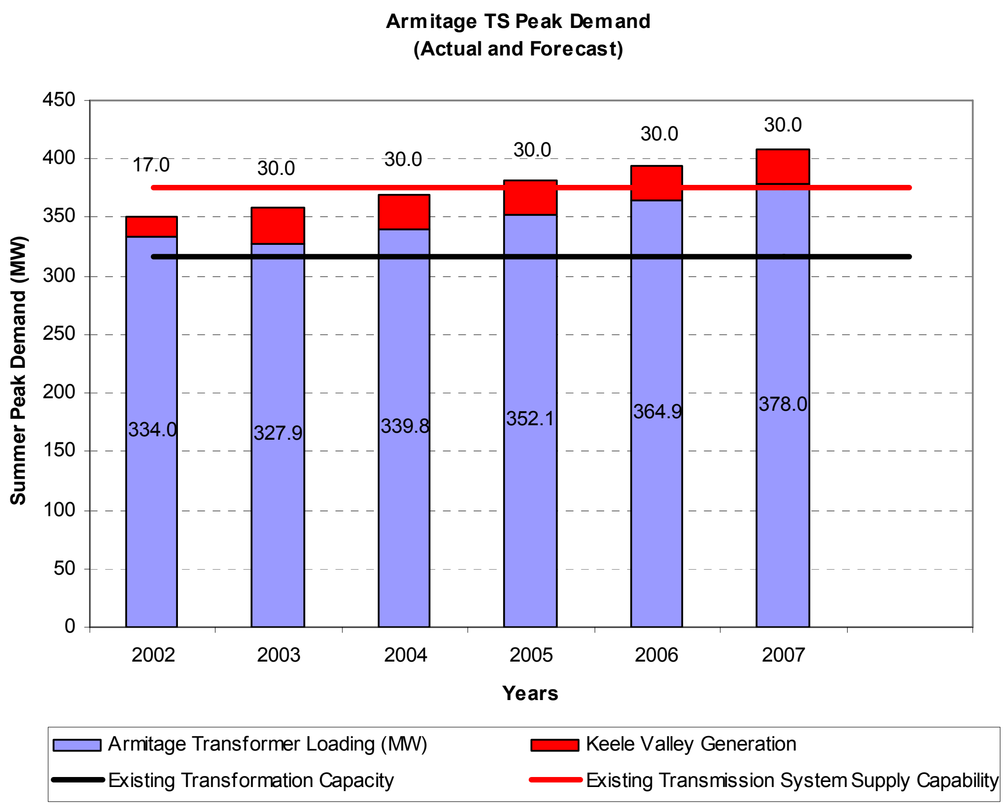


2.3 Specific Bottlenecks in Northern York Region Supply

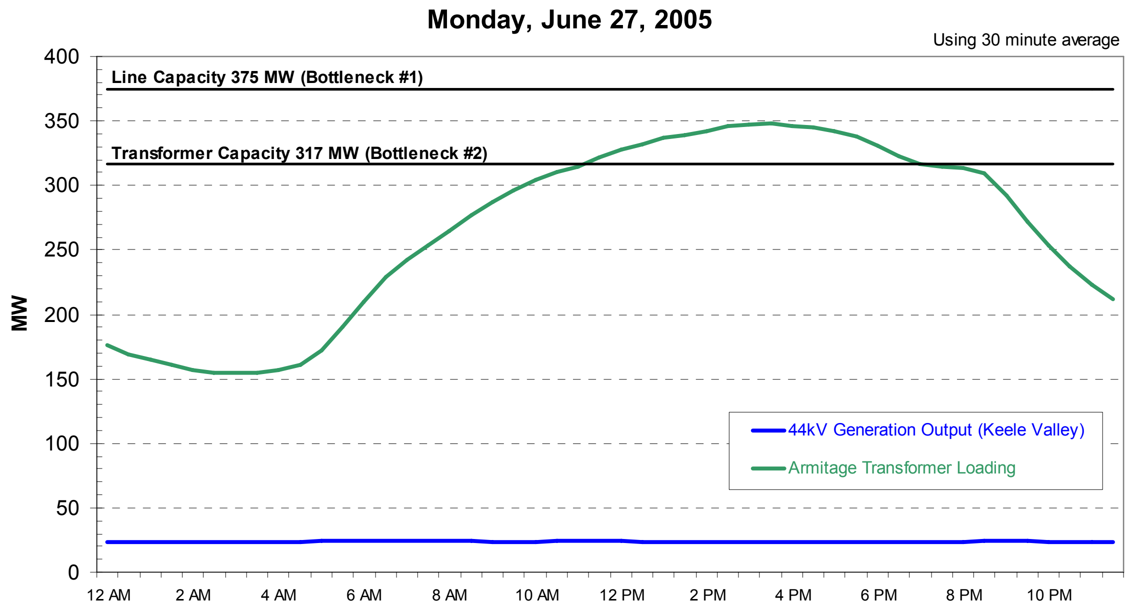
2.3.1 Transformation Gaps

The present supply arrangement is two transformer stations with a total of four transformers on the Armitage site.

Those transformers have been subjected to the risk of damaging overloads since 2002. The following bar graph shows historic loading relative to the capacity of the one pair of transformers remaining in service after a first transmission line contingency (the loss of one 230kV line).



This gap in transformer capacity is dependent on the load supplied by the transformer. The load varies seasonally (summer peaking in York Region) and during the course of each day. In the example below, June 27, 2005, transformation capacity would have been exceeded by varying amounts for approximately eight hours of the day, had a single 230kV transmission line been forced out of service.



The specific transformation gap can be summarized as follows:

- Transformation in the form of transformer stations must be provided as close to the centre of load growth areas as possible to allow the provision of short and direct feeders to the loads.
- Transformer station location should take into account interaction with adjacent transformer stations and attempt to form networks with those stations as backup supply in emergencies.
- One 150 MW transformer station is required as soon as possible in Northern York Region. A second transformer station will be required within the ten year horizon and that transformation must be in close proximity to loads and to obtain reliability and loss reduction at appropriate levels. Two areas of load growth are evident, the area north and west of Newmarket and the area to the north and east of Aurora, the former being of the higher priority.
- Transformer stations should be equipped with low voltage shunt capacitor banks or other devices to support the voltage to the maximum extent possible. These devices must be designed to be effective without creating power quality (switching transients) problems.

2.3.2 Distribution System Gaps

Armitage TS has sixteen outgoing 44 kV distribution feeders. Six of these feeders are allocated to Newmarket Hydro, three to Aurora Hydro and seven to Hydro One, and all are fully utilized to supply the customer demand in their area. Presently, Hydro One requires one new feeder, Aurora Hydro requires two, and Newmarket Hydro needs one to effectively serve existing loads. Space limitations and feeder egress constraints do not allow any expansion at the Armitage TS site. Hence, no spare feeders are available to meet new demands. In addition to the present deficit of four, at least eight new distribution feeders will be required over the next 10 years.

Service is presently being provided through a sub-optimal feeder configuration, but this solution is not sustainable and will become increasingly problematic as the need for new feeders increases. Sub-optimal feeder configurations result in greater electrical losses, reduced reliability and ultimately an inability to serve new loads.

The requirements for York Region Distribution are typical:

- This is a 44kV supply area and any new supplies will have to be 44kV.

- Up to twelve feeders will likely be required over the ten year horizon partly to catch up with past inadequacies, and partly to enhance geographic coverage for new load growth areas as part of continuing urban development.

- Feeders should not be loaded beyond about 22 MW each to ensure emergency transfer capability and should not be more than about 20kM in length to contain losses and minimize service interruptions.
- A Feeder "Position" (circuit breakers and controls) is required for each feeder provided to serve new loads. These feeder positions are built into transformer stations.

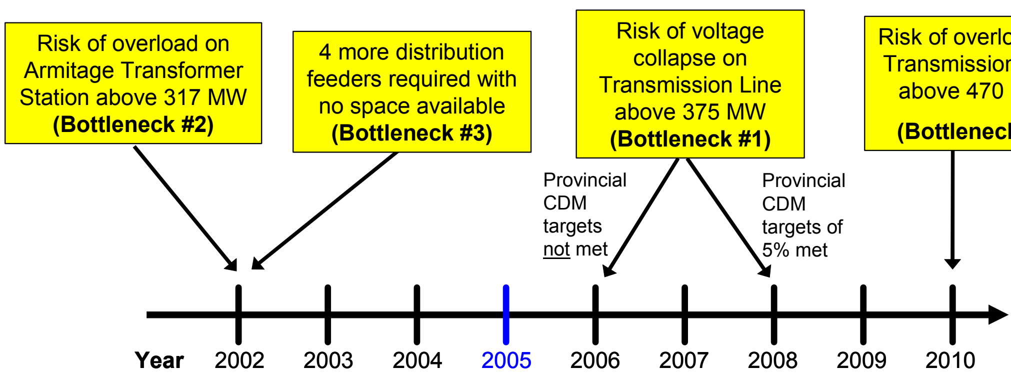
- Where possible load transfer capability from one transformer station to another should be provided by the feeder network to improve diversity of supply to northern York Region.

- Existing and future Conservation and Demand Management will have some effect on feeder loading but will not eliminate the need for new feeders.

- Generation connected to feeders will not decrease the number of feeders required to serve existing and future loads.

2.4 Timelines

Timeline of Bottlenecks in Existing System



2.5 Cost Factors

There are four sets of costs associated with serving new load with new transformation and distribution facilities that have to be taken into account. These and other factors such as societal and environmental have to be taken into account when evaluating alternatives. They are as follows:

- Bulk system supply costs
  - Augmentation of generation capacity
  - High voltage transmission line costs
- Transformer station capital costs
- Distribution feeder capital costs
- Cost of electrical losses.

2.5.1 Bulk System Supply Costs

Generation capacity has historically not been considered in distribution system planning decisions because Ontario has been in a generation surplus position for many years. In that environment, the energy supply for the new load was inevitably served by abundant system generation. In 2005 however, the power system is deficient in generation and local generation close to the new load is an alternative. The proximity and connection of local generation now has an effect on the choice of transformer station alternatives.

In the historic paradigm a transformer station option where the station was in the proximity of a transmission line with adequate capacity would enjoy the benefits of reduced capital costs and likely be preferred. In the 2005 paradigm the two cost factors of "Augmentation of generation capacity" and "High voltage transmission line costs" are integrated into one category called " Bulk System Supply Costs". In practice this means a station location or high voltage connection that offers the best overall bulk energy supply, be it local generation or remote generation and associated new high voltage transmission line, will be preferred. These costs are dealt with in Exhibit D "Transmission" and will not be repeated here.

2.5.2 Transformer Station Capital Cost

Transformer station capital costs are typically $15M in Ontario. For purposes of selecting alternative options for Northern York Region, the cost of the alternatives will always be more or less the same. It is possible to fine tune these numbers by attempting to anticipate specific transformer station sites and identifying possible land and other costs but the differences will not influence the outcome of the decision process. Functional considerations and the costs of bulk supply and distribution will ultimately determine the required course of action. All new transformer stations are assumed to be $15M.

2.5.3 Distribution Feeder Capital Costs

Distribution feeder costs are determined by several factors and it is not possible to generalize about the costs for a typical new station. It is however possible to generalize about the factors that determine cost:

- Availability of feeder egress from the station
- Existing congestion along roadways
- Length of feeders required to supply new load.

Because the circumstances are unique in each case, the use of per-unit costs is not practical in this study. In some cases estimates for alternatives or differentials between alternatives have been estimated and appear in the evaluations. Qualitatively speaking, the effects of the above factors are as follows:

Availability of egress from the station relates to getting the feeders from the circuit breakers inside the station property to the roadside adjacent to the station. Egress difficulties come up when there is not enough space along the roadside to accommodate the required connections. The lowest cost alternative is to provide overhead connections between the station circuit breakers and the roadside poles. If space for such connections becomes limited, it becomes necessary to provide short underground cables between the circuit breakers and the poles. Further congestion may require running some of the feeders some distance underground to a point where there is space for overhead wires. Greenfield sites provide least cost station egress costs.

Existing congestion along roadways refers to existing pole lines already in place that interfere with new feeder construction. These pole lines can be existing lower voltage distribution wires, telephone wires, street lighting or other services. When the new feeders are added all of the existing infrastructure has to be dealt with, usually by incorporating those services on the same poles as the new feeders. This work must usually be done without disrupting existing services and this can dramatically increase costs. In extreme cases congestion prohibits the use of existing roadsides at all and new feeders have to be routed along less direct and more expensive roads.

The length of feeders to supply new loads is an obvious contributor to costs. Ideally a new transformer station is situated as close to the geographic centre of new loads as possible. Transformer stations are seldom if ever located outside the service territory of the station.

The costs of distribution can vary even an order of magnitude if the transformer station site is not carefully chosen.

2.5.4 Distribution Feeder Losses

Whenever power is delivered along wires, the wires heat up and dissipate heat into the environment. Financially this represents a loss in that the production of the electricity and the upstream losses in delivering the lost energy is all wasted. This wasted energy will have required fuel to produce and will therefore have had have had a negative effect on the environment. Transmission and distribution system designers endeavor to build systems that reduce these losses. Although transmission and distribution system megawatt hour losses do not "explicitly" appear in ratepayers electricity bills, they appear indirectly as transmission and distribution costs. It is in the interest of all ratepayers to reduce electrical losses and their reduction contributes significantly to the provinces energy efficiency.

There are several methods used to reduce losses:

- Feeders are built using the largest wires that the poles will support. The larger wires heat up less with the same power flows and result in reduced losses.
- Feeders are made as short as possible. This can only be achieved by locating transformer stations close to the loads served.
- Load balancing is done to ensure that all of the available feeders share the load. Losses increase in proportion to the square of the current flowing. Overloaded feeders

therefore contribute dramatically to losses, and additional feeders are often required to share the load and avoid the severe losses.

It is difficult to quantify losses without a detailed and complex study for each feeder involved. Such studies are complex because the load profile has to be modeled in great detail as well as the physical characteristics of the feeder or proposed feeder. The problem is approached in a more practical manner by placing normal maximum lengths and maximum loads on feeders and on balancing the loads by building adequate numbers of feeders.

The Northern York Region study uses this practical approach to assessing the relative costs of losses.

3 TRANSFORMER STATION OPTIONS

Four different transformer stations were proposed for meeting the Northern York Region supply gap. Each is connected to a different part of the transmission system, each has its own advantages and disadvantages and more than one will ultimately be required.
They are:

- Buttonville TS (OEB Option 2 - second station on the existing site)
- Holland Junction TS (OEB Option 3)
- Aurora TS
- Gormley TS.

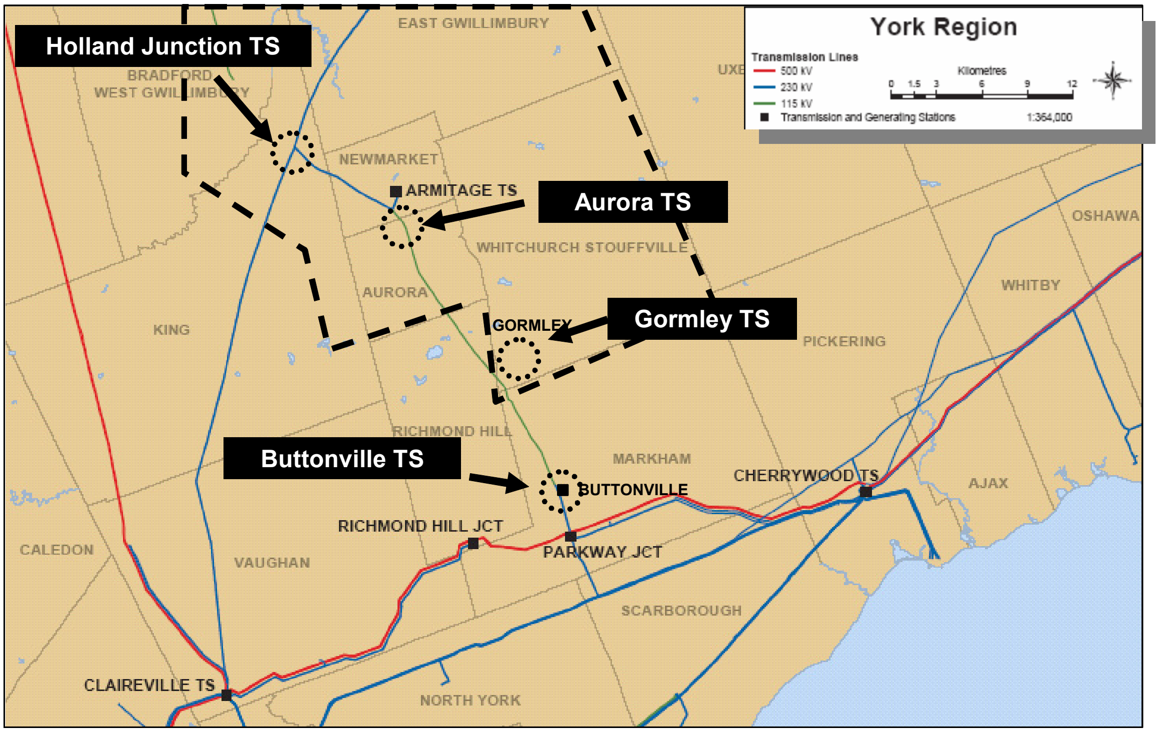


Figure 1: Map showing potential transformer station locations

3.1 Buttonville TS

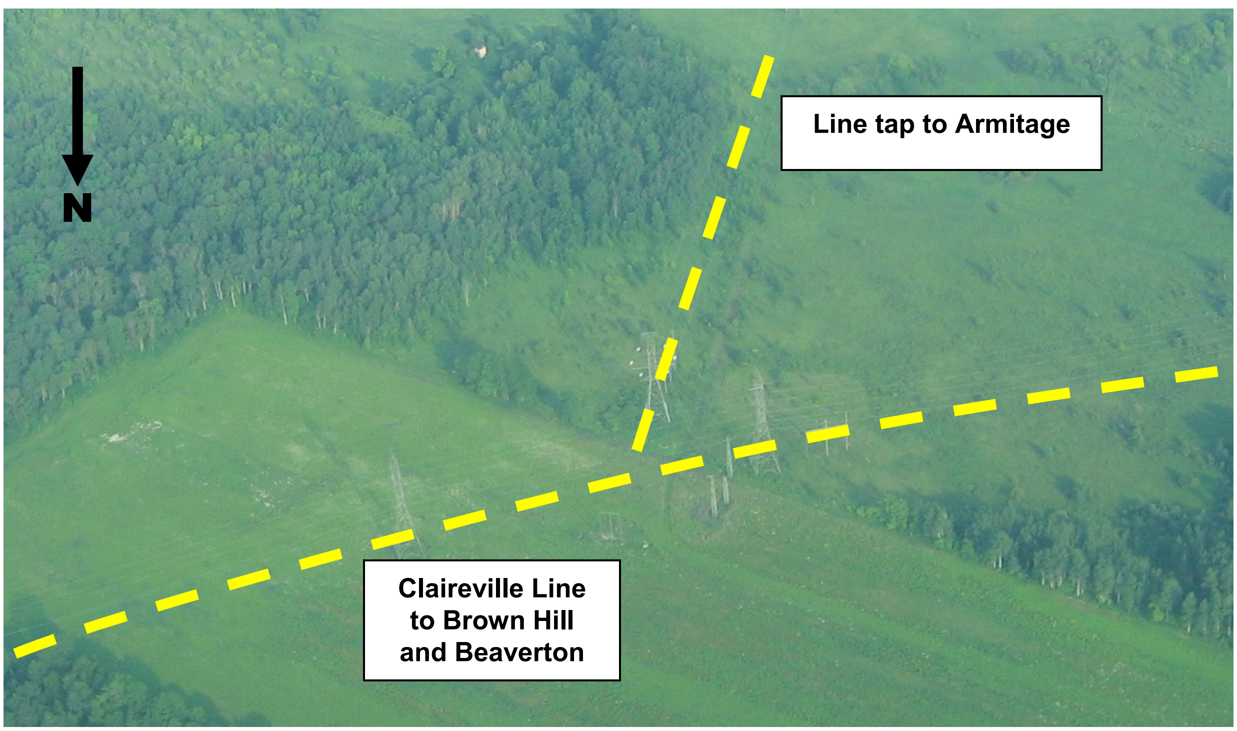
This is option 2 as identified in the letter of direction from the OEB. The option consists of building a 230/44 kV transformer station at the site of the existing Buttonville TS and running 44 kV feeder lines to Aurora, Newmarket, and Whitchurch-Stouffville. The existing Buttonville TS provides transformation down to 28kV distribution voltage used in southern York Region. A second Buttonville transformer station would provide transformation down to the 44kV voltage used in Northern York Region. The second station would be supplied from Parkway TS using the same 230kV lines that feed the existing station. Most of feeders from the second station on the site would be quite long as most of the load served would be in Newmarket and Aurora.

There are three advantages to this option. The first is that there is space at the existing Buttonville site for an additional transformer station and no new site would have to be developed. The second advantage is the existing and adequate 230kV supply available on the site. The third advantage is that the available 230kV supply is independent of the 230kV transmission lines supplying Armitage TS, resulting in increased supply diversity for the Northern York Region area.

There are several significant disadvantages to this option, all relating to the length of the feeders that would be required to supply the load. These were highlighted in a report submitted to the OEB by the local distribution utilities titled "Collective Response to the OEB Direction of June 28, 2005 ("Collective Response")". The first disadvantage is the capital cost of building the required distribution system distant from the load. Their estimate for the capital cost is a relatively high $47 to $57 million depending on the routing of the feeder lines. There are also significant distribution losses associated with this option because of the long feeders. The secondary losses were estimated to be 9 MW above the typical losses for a more conventional station and feeder arrangement. Finally, the reliability provided by the arrangement will be sub optimal because the long feeders are more exposed to the elements and more likely to be disrupted by lightning and other factors.

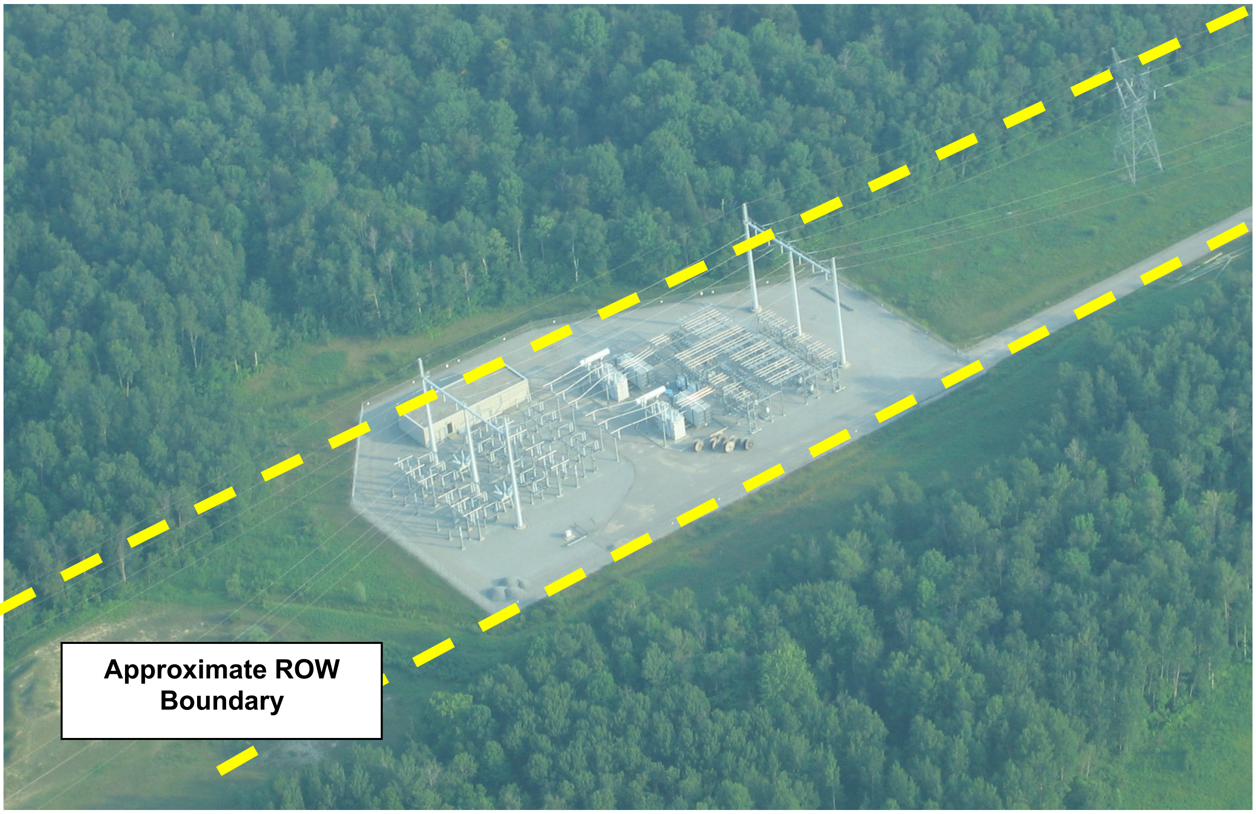
3.2 Holland Junction TS

Construction of a transformer station at "Holland Junction" is OEB option 3. This is the location where the line tap to Armitage TS intersects the line from Claireville to Minden, as pictured below.



Holland Junction

The new station would be constructed somewhere in the vicinity of the tap. The precise location will depend on road access, the availability of suitable land and the ability of routes for feeders leaving the station. To minimize the environmental impact of a new station, the station will most likely be constructed along the existing ROW, as a "right of way station", similar to the arrangement at Brown Hill TS shown in the following picture. An initial purpose of Holland Junction TS would be to off-load Armitage TS through load transfers to the new station. A second purpose would be to provide new feeders required to serve existing and growing loads in the north portion of York Region, King Township and the Bradford area.



Brown Hill Transformer Station

There are several advantages to the Holland Junction TS option. The first is the availability of a site beneath the existing transmission lines allowing the station to be built quickly. The second advantage is the fact that the station would connect to the existing 230kV Claireville to Minden lines at a point "upstream" of the eight kilometre line tap to Armitage TS. Connecting to the 230kV lines at this point avoids using up the capability of the line tap and results in a shorter line length to the station from the main supply point at Claireville TS. This will reduce the effects of voltage drop at the station. The station is centrally located to growing loads and offers reasonable feeder lengths and losses. A final and very important advantage of providing this station is that it enhances the load meeting capability of the existing 230kV lines by offering an ideal location for new capacitor banks that will support the line voltage

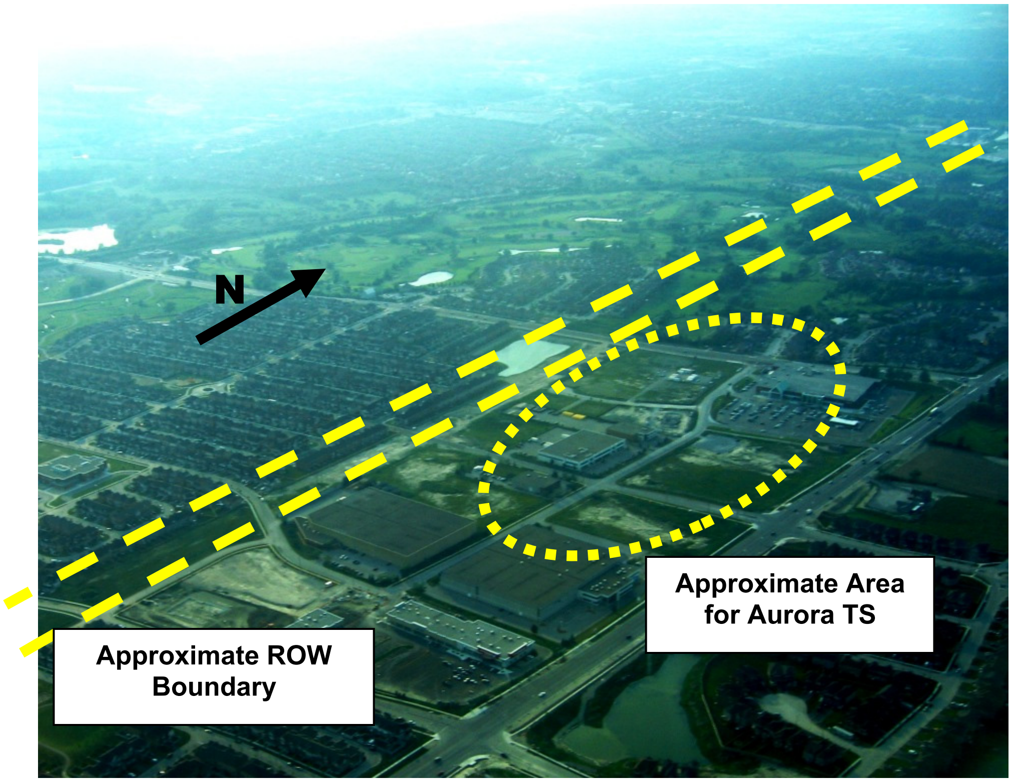
There are some disadvantages associated with the Holland Junction option. The first is that it does not provide a new route for the additional power to Northern York Region, and therefore does not contribute significantly to diversity of supply. It does offer a degree of diversity by virtue of its strategic location. Depending on switching capability the station can be independent of the Armitage TS line tap, and could be supplied from either the north or south should a major transmission line failure occur.

This option is an attractive first step because it can be constructed quickly and offers wide range of benefits that provide value in the short and long term.

3.3 Aurora TS

Aurora TS was one of the elements considered in the 2003 plan to provide new capacity to Northern York Region. At that time, the plan was to supply such a station using a 230 kV line from Buttonville TS in the south. In the current plan, Aurora TS would be supplied from the north by a short 230 kV line. This station would be built in an industrial area adjacent to the existing Buttonville-Armitage right-of-way, about two kilometres south of Armitage TS. Line taps of approximately 1.6 kilometres would have to be constructed along the route of the existing Buttonville-Armitage ROW replacing the old line. The station would supply industrial and other loads in Aurora as well as other loads to the east.

Aurora TS would be built partly to provide transformation capacity in Northern York Region and partly to provide new distribution feeders in its geographic area at a future date when the capacity and feeders are required.



The Aurora TS option has a number of advantages. It would be ideally situated to supply new and growing loads through short feeders. Another advantage is the moderate cost because of the short 230 kV lines and feeders. Finally, Aurora TS would provide another opportunity to install capacitor banks for voltage support in Northern York Region.

This option also has several disadvantages. The first disadvantage relates to providing a bulk supply to the station. As an immediate option this station would require the completion of a 230 kV supply line that would require additional time to complete. As a longer term option, this requirement for additional time is not an issue. The second disadvantage is that the 230 kV supply to this station would not be independent of the supply lines to Armitage TS, and the station would not in itself offer significant additional diversity to the Northern York Region supply. This can be mitigated, however, by ensuring that the local generation is connected in a manner to offer diversity of supply to the area.

This option is an attractive second step because it avoids the high costs associated with long 230kV transmission lines and provides a wide range of benefits.

3.4 Gormley TS

Gormley TS is an alternative to Aurora TS and would be built instead of Aurora TS if local generation cannot be provided in Northern York Region. Gormley TS would be located somewhere in the Stouffville Side Road area and supplied by a 230kV transmission line from Buttonville TS. The location of this station is a compromise that would minimize the high cost of building 230kV lines from Buttonville by locating the station as far south as possible while also being far enough north to be reasonably close to the load that it would serve. Gormley TS would serve industrial and other loads in Aurora as well as other loads to the east. Figure 1-X above shows the approximate location of Gormley TS. No site has been identified for Gormley TS, but it would be adjacent to or on the existing 115kV line right of way. Approximately 10 km of double-circuit 230 kV line would have to be built to supply the station.

As a relatively long transmission line would have to be built to Gormley TS the time delays involved in providing a line make Gormley TS unsuitable as a short term alternative. It is however a useful option if local generation cannot be provided, and Aurora TS cannot be built.

There are some advantages to the Gormley TS option. The first advantage is that Gormley TS would be supplied from Buttonville by lines that are independent of the existing 230kV lines supplying Armitage TS. This would enhance the diversity of supply to Northern York Region by offering an alternative means of supplying some of the load should major transmission line problems occur. A second advantage is the stations southerly location that would reduce the cost of providing transmission lines to supply the load.

There are disadvantages to the Gormley TS option. The first is the cost of having to provide 230kV transmission lines. The second is that the station location which would ideally be further north to reduce feeder lengths and feeder losses. The third disadvantage is that the southern portion of this line would pass through communities that have expressed concern about such a line.

This option is not the preferred second step because of transmission line cost and the need for a slightly more expensive distribution network than Aurora TS.

4 RECOMMENDED SOLUTIONS

The following sections distill the information contained above and present the recommended immediate and long term solutions.

4.1 Immediate Solutions

There is an urgent need for new distribution facilities to serve Northern York Region. Since 2002 there has been a shortage of feeder positions at the existing transformer station at Armitage, and a shortage of transformation capability putting the region at increased risk of service interruption.

Over the long term, two transformer stations will be required to provide a reliable supply to Northern York Region. One must be provided immediately to relieve the existing Armitage TS loading and one will be required towards the end of the study period to provide future geographic coverage and transformation capacity.

All three options other than Gormley TS are available as short term measures to provide relief to Armitage TS. These are the Aurora TS, Buttonville TS and Holland Junction TS options, all of which can be implemented relatively quickly. Gormley TS has a long implementation time and as such is more suitable for the longer term. It also requires a relatively long transmission line that would not be consistent with a long term plan of providing additional supply using local generation.

The immediate solution requires that an option be chosen for a new transformer station that can be completed quickly. The parameters involved in that decision were highlighted in Section 4.2 where each option was described in detail.

Based on the information from the consultation process, the Holland Junction site is the preferred location for a new transformer station to serve Northern York Region. The Holland Junction option is preferred to Aurora TS because it does not require a supply line, and therefore can be constructed more quickly. Holland Junction TS is also situated closer to Claireville TS, which reduces the risk of voltage collapse. The Holland Junction TS option is superior to the Buttonville option in almost all areas including capital cost, distribution feeder losses, and reliability. The only area where Buttonville TS is stronger is in the near term diversity of supply. That advantage will be reduced in the future if local generation is provided in the area and it is connected in a manner that enhances bulk supply diversity.

Residents of King Township have expressed some concern with regard to locating a new transformer station in their municipality. The primary concern expressed related to the appearance and impact of new roadside wood pole feeders near the transformer station. It is possible to mitigate the impact of new feeders by careful design of those facilities and that should be achievable. There was also concern expressed about the use of agricultural land for infrastructure, and for this reason OPA suggests that this station should be built on the existing ROW to the maximum extent that this is practical.

4.2 Longer Term Solutions

The Aurora TS and Gormley TS options are best suited as longer term solutions. If growth for Northern York Region materializes as forecast, and CDM comes in on target, there will be a need for another transformer station near the end of the 10 year study period. The exact timing of this will depend on growth and on the need to provide capacity and new feeders in the areas where load is growing. Because geographic coverage must be provided it will likely be necessary to provide a second transformer station on that basis, even before the first new transformer is fully loaded.

The choice of whether Aurora TS or Gormley TS will be more suitable as a long term solution will be driven by the success of providing local generation in sufficient quantity in Northern York Region. Aurora TS is preferable from a cost perspective and also provides the reduced losses and enhanced reliability offered by a station situated close to the load that it serves. Although preferable, Aurora TS cannot be constructed as a second station connected to Claireville TS unless the required local generation is successfully implemented. Gormley TS is less attractive but remains the best option should local generation not become available.

The Aurora TS option is preferred as the long term solution due to its lower cost, lower losses, better reliability and consistency with the overall supply plan for Northern York Region.