

National Grid
Lockport-Mortimer Line 111 Rebuild Project

Exhibit 3
Alternatives

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EXHIBIT 3: ALTERNATIVES

3.1 Introduction

The Project, as proposed, will replace structures and conductors along Existing Line 111, an approximately 56-mile single circuit 115 kV transmission line that has reached the end of its service life and is in need of replacement. The line was originally constructed as a 69 kV line in 1906 and was later upgraded from 69 kV to 115 kV in 1940. Considering this specific purpose and need for the Project, and the fact that it has been located on an existing right of way for over one hundred years, alternatives that would typically be evaluated for a proposed new transmission facility located on a proposed new ROW are not applicable to this Project.

The following sections discuss the alternative transmission line routes, alternative transmission line technologies and alternative methods for fulfilling the energy requirements of the Project.

3.2 Alternative Routes

The Project, as proposed, will be located in the ROW that was established in 1906 when the Existing Line 111 was originally constructed. This ROW is also the site of the double-circuit Lockport-Mortimer 113/114 lines. At the western end, for approximately 11 miles starting at the Lockport Substation, the ROW is also occupied by the Line 107, Line 108 and Line 112. At the eastern end, for approximately 10 miles starting at Mortimer Substation, the ROW is shared by several circuits and is adjacent to a ROW that is owned and operated by Rochester Gas and Electric (“RGE”). Considering the absence of any significant environmental or land use issues along the existing ROW, and the absence of any plans to relocate these other transmission lines that share this ROW, there are no compelling reasons to relocate Line 111 to a new ROW. Establishment of a new ROW for Line 111 would increase land acquisition costs, environmental impacts and ROW maintenance costs.

Notwithstanding this, an assessment was performed to identify alternative routes for Line 111. Other existing linear corridors (i.e., utility and transportation ROWs) between the Lockport and Mortimer Substations were assessed. The routes and the potential consequences of selection of these alternative routes, as well as their feasibility, are described below. These potential alternative corridors are shown on Figure 3-1.

3.2.1 Northern Alternative

One alternative route that was considered (“Northern Alternative”) would follow the Falls Road Railroad (“FRR”) ROW north from the vicinity of the Lockport Substation along an existing railroad and the Erie Canal through the center of the City of Lockport for a distance of

approximately 2.5 miles. The Northern Alternative would continue to follow the FRR ROW where it crosses the Erie Canal, and then continue easterly in the railroad ROW. The Northern Alternative would continue to follow the ROW of the active FRR line for approximately 40 miles through the towns of Lockport, Royalton, Shelby, Ridgeway, Albion, Murray, Clarendon, and Sweden (see Figure 3-2). This alternative route also would traverse the unincorporated hamlet of Gasport, the developed centers of the villages of Middleport, Medina, Albion, and Holley, and the campus of the State University of New York (SUNY) at Brockport in the Village of Brockport. East of Brockport, the Northern Alternative would follow abandoned FRR rail ROW for approximately 7 miles in the Town of Ogden and through the Village of Spencerport, at which point it would leave the rail ROW and turn due south along an existing RGE transmission line ROW. The Northern Alternative would follow the RGE ROW for approximately 2.5 miles and then join the existing Line 111 ROW for the remaining 8 miles through the Towns of Gates, Chili and Brighton and a small portion of the City of Rochester to the Mortimer Substation. The total length of the Northern Alternative would be approximately 60 miles. In addition, two short tap line ROWs totaling approximately one mile in the Towns of Royalton and Shelby would be needed.

The FRR is an active railroad whose primary businesses include the transport of grain, fertilizer, chemicals, lumber, and food products, and passenger excursions. The FRR, a subsidiary of Genesee Valley Transportation, began operations in October 1996 after it was acquired from Conrail. Figure 3-1 shows the relevant FRR ROW, which is generally located 2 to 6 miles north of and parallel to the existing Line 111. It runs on the former New York Central Falls Road Branch from the City of Lockport, where it connects with a CSX Corporation railroad line. From there, the FRR ROW runs to the Village of Brockport, where it passes through the middle of the SUNY Brockport campus. Between Brockport and the City of Rochester is a 12-mile section of unused railroad ROW; its track was taken up by Conrail around 1994.

The Northern Alternative has several distinct disadvantages. It is approximately 4 miles longer than the existing Line 111. It would require a new 115 kV ROW through the developed centers of Lockport, Gasport, Middleport, Medina and Albion. A review of available aerial photography indicates that various potential land use conflicts would need to be resolved in these communities. The Northern Alternative would also place the new Line 111 in proximity to the Royalton Hartland High School in Middleport, the Spencerport Central School Complex (Spencerport High School, Cosgrove Middle School, and Canal View Elementary School) in Spencerport, and in the center of the SUNY Brockport campus. Significant portions of the route outside of the developed communities, while free of land use conflicts, would require clearing of mature vegetation along the railroad line.

The curves of the railroad ROW would result in many additional angles in the transmission line. Because the width of the railroad ROW is insufficient to guy many of the poles, more real estate expense would be incurred to obtain the necessary additional width for guying. As an alternative, these angle structures would need to be self supporting steel pole structures supported by reinforced concrete foundations. This type of construction is considerably more expensive than wood pole construction.

The acquisition of new easements and other land rights for the ROW would result in commensurately greater costs for the relocation of the existing Line 111 to the Northern Alternative without any apparent environmental or operational benefits compared to the rebuilding of Line 111 along its existing ROW. A conceptual cost estimate was developed for the Northern Alternative, considering ROW acquisition and other capital costs. The total conceptual capital cost for the Northern Alternative is approximately \$58 million, approximately \$25 million more than comparable costs for the proposed Project. For these reasons, the Northern Alternative is less favorable than the proposed Project.

3.2.2 Southern Alternative

The second alternative route considered (“Southern Alternative”) would follow the existing New York Power Authority (“NYPA”) ROW of NYPA’s 345 kV Niagara-Adirondack tie lines, another major east-west linear corridor, as depicted on Figure 3-1. This corridor generally parallels the existing Line 111 2 to 7 miles to the south and is presently occupied by NYPA’s two parallel, single-circuit 345 kV lines located on steel lattice towers. This corridor between the cities of Lockport and Rochester also includes the Empire Pipeline, a 24-inch diameter natural gas pipeline that runs between Buffalo and Syracuse, New York.

The Southern Alternative would proceed south-southwest from the Lockport Substation in the City of Lockport along an existing electric transmission line for approximately 0.5 mile. The route would then turn southeasterly along an unidentified gas pipeline ROW for a distance of approximately 2 miles through the Towns of Lockport and Pendleton, at which point the alternative route would join the NYPA ROW. The Southern Alternative would continue in an easterly direction in the NYPA ROW through the Towns of Royalton, Alabama, Oakfield, Elba, Byron, Bergen, Riga, Chili and Henrietta for approximately 53 miles to RGE’s Station 80. From there, the route would proceed in a north-northeasterly direction for approximately 3 miles to Mortimer Station in the Town of Brighton along an electric transmission corridor shared by RGE and National Grid. In addition to the approximately 59-mile alternative route, three additional ROWs totaling approximately 12 miles would be required in the Towns of Royalton, Alabama, Shelby, Bergen and Sweden to connect existing tap line loads to the relocated Line 111.

The NYPA corridor traverses a rural landscape, similar to the existing Line 111 ROW. A review of existing aerial photography indicates few potential land use conflicts along the Southern Alternative, notwithstanding rural homes at certain road crossings that would need to be avoided. The most significant impact of the Southern Alternative would result from the need to widen an already significant corridor, which would disrupt the visual symmetry of the existing parallel 345 kV lines. The existing NYPA corridor appears to be approximately 300 feet wide, with the placement of the single-circuit lattice structures consistently matched with a separation of 150 feet. The Empire Pipeline is located in the area between the structures, which would force the placement of Line 111 at the outside edge of the existing ROW. Thus, in order to allow for adequate conductor separation, this alternative route would require at least an additional 50 feet of new ROW for the entire 53 miles along the NYPA corridor. This would add significantly to the cost and environmental impact of this alternative.

Additionally, the new single-wood pole 115 kV line has a typical span length of between 500 and 550 feet. The existing 345 kV lines have a typical span length of between 800 and 900 feet. Therefore, the introduction of this Project's new single-wood pole 115 kV line would not likely match many of the existing structure locations. Accordingly, the visual contrast created by the different scale, materials, and location of the new 115 kV line in the open rural landscape along the Southern Alternative would result in an adverse visual impact.

As with the Northern Alternative, the acquisition of new easements and other land rights for the ROW would result in commensurately greater costs for the relocation of the existing Line 111 to the Southern Alternative without any apparent environmental or operational benefits compared to the rebuilding of Line 111 along its existing ROW. A conceptual cost estimate was developed for the Southern Alternative, considering ROW acquisition and other capital costs. The total conceptual capital cost for the Southern Alternative is approximately \$56 million, approximately \$23 million more than comparable costs for the proposed Project. For these reasons, the Southern Alternative is less favorable than the proposed Project.

3.2.3 Iroquois National Wildlife Refuge Bypass Alternative

The Iroquois National Wildlife Refuge ("NWR") Bypass Alternative route was also considered. The area of the Iroquois NWR was reviewed to identify a potential alternative route that would eliminate the one mile traverse of the NWR by the existing Line 111. The Iroquois NWR is located predominantly south of National Grid's existing Line 111 and Lines 113/114 ROW in Genesee County. This ROW is contiguous with the northern boundary of the NWR for a total of approximately 4 miles. For an additional distance of approximately 1 mile, the NWR's northern boundary is approximately 3,000 feet to the north of the ROW (see Figure 2-1c). To avoid this

1-mile section of the NWR as well as the residences developed along the nearby roadways, this alternative route would require multiple road crossings and would establish a new ROW through agricultural fields and woodlands for a distance of more than 2 miles. However, this alternative would not eliminate the crossing of the NWR unless the other lines, the double-circuit Lines 113/114, are also relocated to this alternative. Considering the longer distance, potential impact to residences and the significant adverse environmental impact of crossing the NWR, this bypass alternative was not considered reasonable and was not considered further.

3.3 Expansion of Existing Rights-of-Way

The Project involves rebuilding Line 111 in the centerline of the existing ROW, so no expansion of the existing right-of-way is required to accommodate the rebuilt facilities. Since the proposed facilities do not require any additional ROWs, the expansion of other ROWs owned by National Grid or any other entity was not considered. The EM&CP will indicate any additional ROWs or other land rights required in order to commence construction of the Project and maintain the rebuilt Line 111 thereafter (e.g. temporary and/or permanent access and tree clearing rights, if necessary).

3.4 Alternate Methods to Fulfill Energy Requirements

Alternate methods to fulfill energy requirements considered by National Grid included alternative transmission line technologies, a “no-action” alternative, various system alternatives and the feasibility of demand-side management and distributed generation.

3.4.1 Alternative Transmission Line Technologies

The existing circuit to be rebuilt is planned as a conventional overhead transmission facility consisting of three phases. The existing Line 111 uses several types of conductors along its 56-mile length including “Coot” 795 kcm ACSR 36/1, “Orchid” 636 kcm AL 37/0, and Non-Stan 428 kcm AL 19/0. These existing conductors will be replaced with a 795 kcm ACSR “Drake” 26/7 conductor with a maximum winter STE rating of 324 MVA.

The Applicant considered, as alternatives, other cable technologies such as High Voltage Direct Current (HVDC) and underground cable technologies.

High Voltage Direct Current (HVDC) Technology:

For long transmission lines (ones considerably longer than Line 111), HVDC technology can be an economical alternative because fewer conductors are needed, line losses are reduced and no compensation reactors are required as with alternating current (AC) lines. However, as an alternative for the proposed rebuild of Line 111, HVDC technology would not be cost effective

or technically feasible. Converter stations would have to be built at either end of the HVDC segment. These would substantially increase the costs of the project with no commensurate technological advantage.

Alternate Underground Transmission Line Technologies:

An underground alternative to the proposed Project was examined on a screening level. Rebuilding this approximate 56-mile segment of Line 111 as an underground facility was found to have significantly increased costs, greater environmental and construction impacts and significant system operating impacts. A small portion of the existing Line 111, approximately 2,000 feet, is currently located underground as it crosses Runway 4/22 of the Greater Rochester International Airport. This portion of Line 111 will remain unchanged when the overhead line is rebuilt. It will be the only portion of the line that will not be reconductored.

There are two viable underground construction alternatives at 115 kV: (i) high pressure fluid filled (“HPFF”) pipe type cables, and (ii) solid dielectric cables. HPFF pipe type cables consist of three cables installed in a steel pipe which is filled with dielectric fluid pressurized at 200 psi. Solid dielectric cable systems consist of three cables insulated with plastic or rubber. This type of cable is typically installed in a duct and manhole system. Each cable system requires manholes at periodic intervals for splicing.

Reconstruction of the existing line in either underground configuration would result in considerably greater impacts than the proposed overhead rebuild configuration. If the line is installed underground along the existing right of way, the impact would be mostly to the environment, and construction activities would require additional controls to protect sensitive environmental areas. If the line is installed along or within public roadways, then the construction activities would have a greater impact on the public due to noise and traffic disruption.

The existing Line 111 crosses the Genesee River and Interstate 490, among numerous other waterbody and road crossings. These crossings would require specialized engineering and construction techniques (e.g., horizontal directional drilling or pipe jacking). The proposed primary route for the Project also crosses the Iroquois NWR and active agricultural land. Excavation of a continuous trench and the placement of manholes in these areas would result in far greater environmental impact and the need for more extensive restoration than would be required for overhead construction.

In addition to public and environmental considerations, there are operational issues associated with underground transmission circuits. Outages on underground cables require specialized fault

locating techniques and equipment and complex repair procedures resulting in lengthy outage durations. Since outages are longer in duration, additional switching facilities are often required at the transition points to provide operational flexibility. Underground cables require additional and more sophisticated relaying to prevent inadvertent reclose operations into cable faults. These switching and relaying systems typically require more complex transition substations for the overhead to underground transition points.

Underground cables also have different electrical characteristics than overhead lines. Underground cables generate larger charging currents and have lower reactance than overhead lines. These characteristics can impact system voltages and flows which may require the installation of additional equipment, such as shunt or series reactance as compensation. Underground cables have different power capabilities which result in a much larger required conductor size or multiple conductors per phase to achieve a capacity comparable to a single overhead line.

Due to higher material and installation costs, underground transmission facilities are typically three to ten times the cost of similar overhead transmission facilities. Considering the increased construction impacts, environmental impacts, operational challenges and the associated increased costs, the underground option was eliminated from further consideration for this Project.

3.4.2 No Action Alternative

The no-action alternative is not considered viable because the proposed Project is being undertaken to rebuild an approximately 56-mile single circuit 115 kV transmission line that is more than 100 years old and has served its useful life. Selecting the no-action alternative would not satisfactorily address continued maintenance and reliability of this critical electric transmission facility as well as the overall safety of the public. With the no-action alternative, National Grid would face immediate and ongoing reliability concerns and would nonetheless continue to replace individual structures on an as-needed or emergency basis without the opportunity for comprehensive upgrade and replacement of the existing conductors.

3.4.3 System Alternatives

In 2004, National Grid conducted system studies to evaluate options for the refurbishment of the three 115 kV circuits between Lockport and Mortimer Substations; namely the single-circuit Line 111 and the double-circuit Lines 113 and 114. The options that were studied included the replacement of the existing three lines between Lockport and Mortimer with two 115 kV single-circuit lines, the replacement of the existing lines by one 115 kV double-circuit line and upgrading the voltage of the lines to 230 kV and 345 kV.

Although initial consideration was given to upgrading the lines to either 230 kV or to 345 kV, these options were eliminated from detailed consideration for several reasons. The options that included either a single-circuit or double-circuit 230 kV line would have introduced a new voltage level in a region that is mostly 115 kV. This increase in voltage would have required customer-owned and municipal substations served by the existing lines to convert to the higher voltage. The 345kV line was also considered. However, the upgrade to 345kV required either the expansion of the existing ROW or the need to completely relocate the line to a new corridor. These potential ROW issues eliminated this option. Other considerations with both the 230 kV and the 345 kV options included higher costs and too much load loss for single contingency.

The options that were evaluated in the system studies assumed the use of a 795 ACSR type of conductor. Based on the thermal analysis, this conductor size was considered sufficient for the throughput as well as the supply requirements for loads tapped off the subject lines for the near term. However, considering a potential increase in the throughput requirements along the subject lines from, for example, possible installations of renewable energy generation in or near these rights of way, options for higher transfers were examined. These options included: 1) installing bundled conductors in each of the new circuits; and 2) installing composite conductor types - Aluminum Conductor Composite Reinforced (“ACCR”). This analysis showed that while it is possible to increase the capacity of the Lockport-Mortimer 115 kV lines by using bundled conductor construction or new technology solutions like ACCR type of conductor, other transmission limitations in the region would need to be addressed before being able to effectively use an increase in transfer capability for the Lockport-Mortimer corridor.

A deterministic analysis was performed to determine reliability criteria violations, if any, due to the new system configurations with the two 115 kV study options. Also, a comparison of the thermal loadings and voltage levels between the original and the new configuration was performed. This analysis was done on summer peak, winter peak and light load conditions. This was followed by a stability study (performed on a summer peak case only). Subsequently, a probabilistic analysis was carried out to quantify and compare the reliability of a double-circuit line versus two single-circuit lines. The results of these studies indicated that the replacement of the existing three circuits (Line 111 and Lines 113/114) with two circuits with an assumed conductor type of 795 ACSR would be sufficient to satisfy the required throughput MW as well as the local load supply requirements for forecasted 2009 conditions. The impact this change would have on the transmission system outside the 5 year horizon of the study was not considered. It is possible that this change could introduce a system constraint at some point outside this study’s horizon.

Considering the deteriorated, aging condition of the existing Line 111, it was determined that the most prudent course of action was to move forward with the rebuilding of Line 111 while implementing a life-extension program for Lines 113/114 (i.e., select hardware replacement and structure reinforcements). The approach addresses the condition of Line 111, while preserving the ability to either increase the capacity of Lines 113/114 to meet future needs (including the delivery of renewable energy) or to replace them with a single line. In the future, Lines 113/114 will be reevaluated and the best options for refurbishment or replacement of those lines will be determined based on system conditions at that time. If that future analysis determines that the system performance and the reliability of service will not be negatively impacted by reducing the number of circuits from three to two, that plan could be implemented.

3.4.4 Energy Efficiency, Demand Response and Distributed Generation

Energy efficiency, demand response, and distributed generation are critically important to meeting the needs of New York electric customers in a reliable and cost-effective manner while meeting the State's environmental and greenhouse gas reduction goals. However, they do not serve the same purpose as the proposed Lockport-Mortimer Line 111 Rebuild Project, which is intended to address the current physical condition of a critical electric transmission facility and to meet National Grid's obligation under the New York State Public Service Law to supply reliable and essential electric service to its customers. As discussed in Exhibit E-4, the existing Lockport-Mortimer Line 111 is in poor condition, with a high percentage of deteriorated structures along the line. The line's poor condition continues to affect its overall performance. National Grid assesses this transmission line as one of its three worst performers in its US service territory. Implementation of energy efficiency, demand response, and distributed generation cannot address the physical condition of the line, and therefore is not a functional substitute for the Project.

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Lockport-Mortimer Line 111 Rebuild Project

Exhibit 3 – Figures