

***PJM Generator Interconnection
Queue O47 Nora 10MW
(10MW Energy and 2MW Capacity)
Feasibility / Impact Study***

January 2006
DMS #356312

General

The Nora project is an Oak Prairie Windfarm, L.L.C. wind generation interconnection request for a generating facility that will be located in Lena, Illinois. The Nora Oak Prairie Windfarm project will use five 2.1 MW wind turbine generators for a total aggregate rated size of 10 MW net output (gross generator output minus load and losses) at the Point of Interconnection to the ComEd system. The Nora Oak Prairie Windfarm project is scheduled for commercial operation in September, 2006.

Direct Connection Requirements

The Nora Oak Prairie Windfarm project can be connected to the ComEd 34.5 kV circuit L18031 as shown on the ComEd Feasibility Study Project Diagram included in Attachment 1.

Interconnection Customer Scope of Direct Connection Work

Interconnection Line

The Interconnection Customer assumes responsibility for design and construction of a radial 34.5 kV line to connect the Interconnection Customer's wind generation to circuit L18031. The Interconnection Customer will own and operate the radial 34.5 kV line from the POI (Point of Interconnection) to its generation site.

Interconnection Customer Facilities

The Interconnection Customer will be responsible for design, construction and operation of all facilities on the Interconnection Customer's side of the POI except as included below in ComEd's scope of work. The IC will be required to install relay protection at the IC's facilities, in accordance with ComEd's Plan C Requirements, for the protection of ComEd's system (see Attachment 2).

Revenue Metering and SCADA Requirements

For PJM: IC will be required to install equipment necessary to provide Revenue Metering (KWH, KVARH) and real time data (KW, KVAR) for IC's generating Resource. See PJM Manuals M-01 and M-14D, and PJM Tariff Section 58.1 through 58.5.

For ComEd: IC will be required to install equipment necessary to provide bi-directional Revenue Metering (KWH, KVARH) and real time data (KW, KVAR, circuit breaker status, and 34.5 kV voltage) for IC's generating Resource. See ComEd Applicable Standards available on the PJM website ("TO Standards") for Commonwealth Edison Company's Meter Department Guide No. MDG-1. The ComEd "DG Book, Guidelines for the Interconnection Of Distributed Generation to the ComEd System", available from ComEd, describes metering and telemetry requirements, for generators less than 20 MW, on page 10.

Interconnected Transmission Owner (ComEd)
Scope of Direct Connection Work

The total estimated cost for ComEd's direct connection construction work is **\$ 249,041**. The lead time required for construction of the direct connection facilities is **6-9 months**.

ComEd Scope of Work consists of the following:

At TSS 180 Lena

\$ 54,844 Install switch, transfer trip and protection relaying..

At Interconnection Site

\$ 67,127 Engineer and install pole taps, switch, SCADA package, etc.

\$ 68,629 Project Management, Construction Management and Materials Management.

\$ 55,441 Engineering coordination, oversight and testing.

\$ 3,000 Insurance and Liability

\$ 249,041 Total estimated cost of ComEd Scope of Work

Network Impacts

The system, as planned, was evaluated for compliance with reliability criteria. The Nora Oak Prairie Windfarm Project was studied as a 10 MW (2 MW Capacity) generating resource. The results are summarized below.

Generator Deliverability

No problem identified.

Local System Impacts- (Normal conditions, all facilities in service)

None.

Stability Analysis

Not applicable for small generators connected to the distribution system.

Short Circuit Analysis

No problems identified.

Network Upgrade Requirements

None.

Local Upgrade Requirements

None.

ATTACHMENT 1
(Preliminary Project Diagram)

PROJECT DIAGRAM # 7P061400

FOR REPLY TO SEA# _____
 FOR ESTIMATE OF PRELIMINARY PLAN
 REGION: NORTHWEST/FREEPORT
 PROJECT ID: FSD030A
 ITM #: 6861

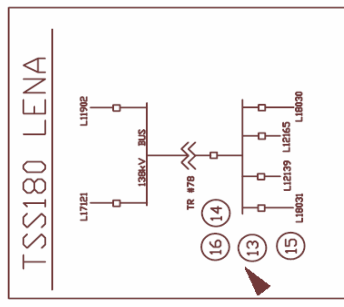
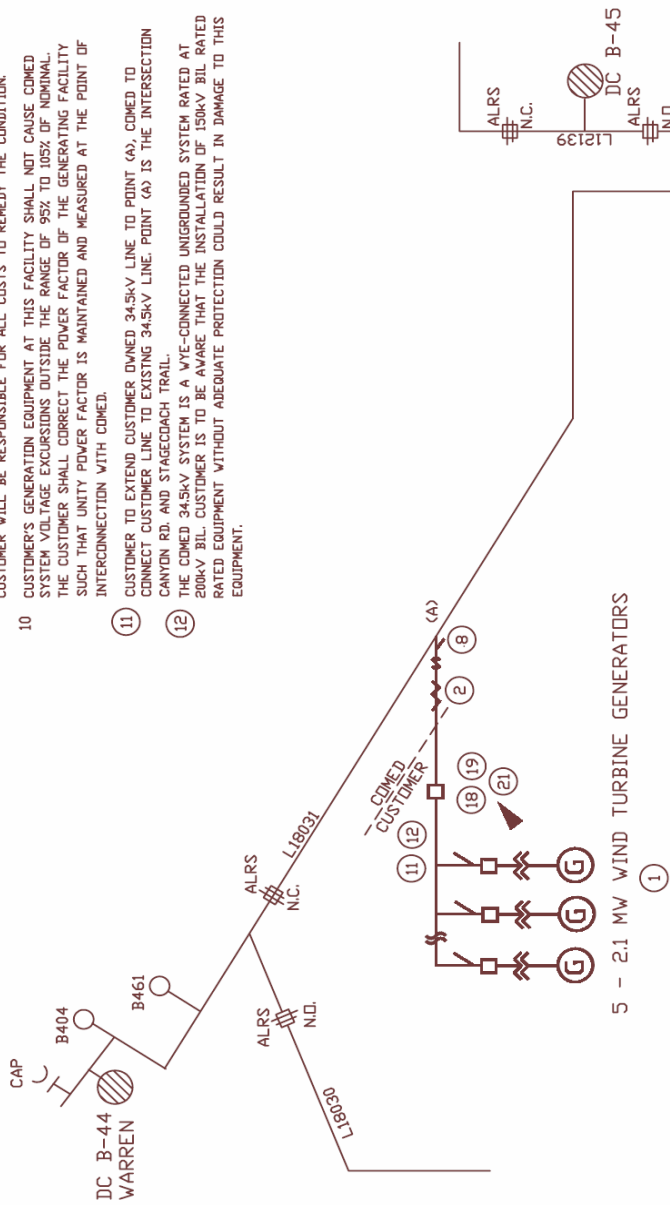


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NOTES

- 1 CUSTOMER IS INITIALLY INSTALLING 5-2100KW WIND TURBINE GENERATORS.
- 2 METERING TO BE COORDINATED WITH SYSTEM METER REFERENCE AND SHALL INCLUDE REGISTRATION OF GENERATOR OUTPUT.
- 3 MINIMUM LINE LOAD ON L18031 IS 1650 KVA AT TSS180.
- 4 LINE IMPEDANCE VALUES FOR 34 kV LINE L18031 ARE: FROM TSS 180 TO TAP POINT (A) Z=3.49 + J7.32 IMPEDANCE VALUES INDICATED ARE FOR PRESENT LINE CONFIGURATIONS. COM ED SYSTEM IS SUBJECT TO CHANGE AT ANY TIME DEEMED NECESSARY BY COM ED AND WITHOUT NOTICE TO CUSTOMER.
- 5 MAXIMUM AVAILABLE FAULT CURRENT IS 1800A 3 PHASE SYM AT 34.5KV AT POINT (A). MAX. FAULT CURRENT W/TSS121 DUT IS 1565A 3 PHASE MAX. FAULT CURRENT W/TSS180 DUT IS 1200A 3 PHASE
- 6 BACKUP IMPEDANCE ' At TSS 180 = J317
- 7 CUSTOMER RESPONSIBLE FOR ALL COSTS ASSOCIATED WITH REQUIRED WORK.
- 8 INSTALL 600A GANG OPERATED SWITCH (2 loc.)

- 9 CUSTOMERS OPERATION MUST CONFORM TO COMED VOLTAGE LIMITATIONS (SEE ATTACHED PG 2). IF CUSTOMERS OPERATION CAUSES OBJECTIONABLE FLICKER, THE CUSTOMER WILL BE RESPONSIBLE FOR ALL COSTS TO REMEDY THE CONDITION
- 10 CUSTOMER'S GENERATION EQUIPMENT AT THIS FACILITY SHALL NOT CAUSE COMED SYSTEM VOLTAGE EXCURSIONS OUTSIDE THE RANGE OF 95% TO 105% OF NOMINAL. THE CUSTOMER SHALL CORRECT THE POWER FACTOR OF THE GENERATING FACILITY SUCH THAT UNITY POWER FACTOR IS MAINTAINED AND MEASURED AT THE POINT OF INTERCONNECTION WITH COMED.
- 11 CUSTOMER TO EXTEND CUSTOMER OWNED 34.5KV LINE TO POINT (A), COMED TO CONNECT CUSTOMER LINE TO EXISTING 34.5KV LINE. POINT (A) IS THE INTERSECTION CANYON RD. AND STAGECOACH TRAIL.
- 12 THE COMED 34.5KV SYSTEM IS A WYE-COMNECTED UNIGROUNDED SYSTEM RATED AT 200KV BIL. CUSTOMER IS TO BE AWARE THAT THE INSTALLATION OF 150KV BIL RATED RATED EQUIPMENT WITHOUT ADEQUATE PROTECTION COULD RESULT IN DAMAGE TO THIS EQUIPMENT.



DATE	REVISION	BY
01/03/06	Add Relay Notes	DM/JMP
PROJECT DIAGRAM Distribution Planning		
WIND FARM 10 MW, NDRA L18031		
D. MUELLER		
DATE 8/10/05		
PAGE 01 OF 02		
Planning Issued		

Program Code 85
 Planning Date 12/31/06

PROJECT DIAGRAM # 7P061400

FOR REPLY TO SER# _____
 FOR ESTIMATE OF _____
 PRELIMINARY PLAN _____
 REGION: NORTHWEST/FREEPORT _____
 PROJECT ID: # P.SD300A _____
 IIN # 6861 _____

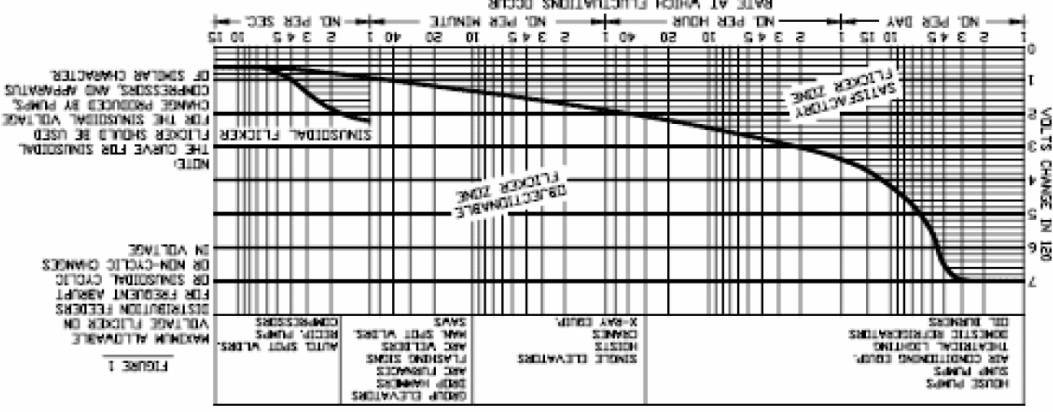
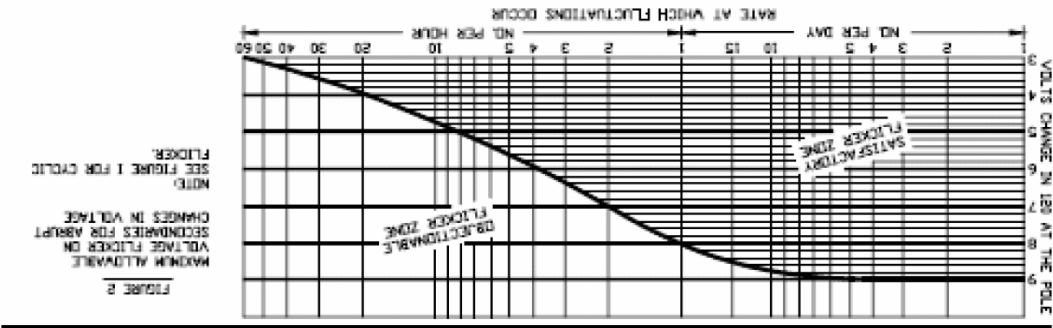
NOTES :

- 13 At TSS 180, remove existing L18031 relay package (Z1 & Z2 KDS, 51/CD-9, 67G/IRD-91 & 79/SEL-279Hz reclosing relay). Install SEL311B as primary protection 21-1, 21-2, 21-3, 21-4, 21-5, 27 & 59) and SEL311A for back-up protection similar to GDD2054. Connect SEL311A & 311B relay breaker failure trips to initiate the 94-1B3 tripping relay. Retain existing 99RE/KUL relay for SCADA reclose enable/disable connect per GDD2054. Connect relays to existing line CT circuits (IA, IB, IC, Ipad). Connect PTs as in notes 14 & 15. Program line relaying to include load encroachment protection to increase line loadability. Retain existing SCADA metering for a 94-1B3 bus trip.
- 14 Existing 3001 Bus 2 PTs. Connect to Va, Vb & Vc on SEL311B & SEL311A (L18031). Existing polarizing potential not used.
- 15 At TSS 180, install 34.5 kV 3001 Pot Transformers on L18031 A & B or A & C phases Pots to be connected grounded-wye on primary. Connect pots to SEL311B Vs synch check input per GDD2054_01 as Vab or Vbc as appropriate. If necessary due to space constraints, remove existing 34.5 kV backfeed detection pot device on 34.5 kV L18031 and install an appropriate voltage relay on synch PT circuit to provide SCADA backfeed indication.
- 16 Install Transfer Trip Transmitter to isolate customer generation for an open ConEd L18031 CB or for a 94-1B3 bus trip.
- 17 Due to relaying constraints, L18031 shall not be tied to L18030 post Switch 3071 (back to TSS 180) except momentarily for switching while customer generation is in service.
- 18 Install Transfer Trip receiver for Received Transfer Trip from TSS 180 on L18031. Transfer Trip communications circuits to be installed, maintained and repaired in a timely manner by the customer. Customer to provide two class "A" 4 wire phone lines for this equipment. ConEd requires constant monitoring of the Transfer Trip channels via SCADA.
- 19 Customer to install relaying at customer site per ConEd DG book Plan C, modified as follows:
 - Customer to install a 34.5kV circuit breaker or circuit switcher at the point of inter-connection to the ConEd system capable of isolating customer's distribution facilities from the ConEd system in three cycles or less.
 - Customer to install appropriate relaying at the customer's primary breaker or circuit switcher capable of detecting all faults on the customer's 34.5 kV feeder system. Relaying is to coordinate with ConEd's line relaying.
 - DG Book Plan C 21-1 and 3B relaying will not be required.
 - Assuming induction-type generators, synch check at the customer's site will not be required.
- 20 Customer relaying to be installed and maintained by customer at customer expense.
- 21 ConEd to install SCADA at the customer's location per the DG Book page 11. SCADA communications circuits to be installed, maintained and repaired in a timely manner by the customer at customer's expense. See SCADA spec for details.
- 22 This plan does not cover cost for wholesale use of the distribution system.
- 23 Relay specs will be issued for this project.

DATE	REVISION	BY
01/03/06	Add Relay Notes	DM/JMP
PROJECT DIAGRAM Distribution Planning		
VIND FARM 10 MW NDRA L18031 D. MUELLER ----- ----- ----- DATE 8/10/05		
PAGE 02 OF 02 Planning Issued		
DATE _____		

Program Code 85
 Planning Date 12/31/06

Function	TSS 180	Dak Prairie Wind Farm	(R)
LTT, 94-1B3 TT	(T)		



ATTACHMENT 2

(Relay Notes and ComEd Plan C Requirements)

Relay Notes for PD # 7P061400

Wind Generation Interconnection:
Install 10.5 MW Wind Generation
at
Nora Oak Prairie Wind Farm
On 34.5 kV L18031
REV 0 (12/02/05)

13. At TSS 180, remove existing L18031 relay package (Z1 & Z2 KD's, 51/CO-9, 67G/IRD-91 & 79/SEL-279H2 reclosing relay). Install SEL311B as primary protection (21-1, 21-2, 21-3, 67G, 79, 25, 27, & 59) & SEL311A for back-up protection similar to GDD 2054. Connect SEL-311A & 311B relay breaker failure trips to initiate the 94-1B3 tripping relay. Retain existing 99RE/KUL relay for SCADA reclose enable/disable; connect per GDD 2054. Connect relays to existing line CT circuits (IA, IB, IC, Ipol). Connect PT's as in notes 14 & 15. Program line relaying to include load encroachment protection to increase line loadability. Retain existing SCADA metering.
14. Existing 300:1 Bus 2 PT's. Connect to Va, Vb, & Vc on SEL311B & SEL311A (L18031). Existing polarizing potential not used.
15. At TSS 180, install 34.5 kV 300:1 Pot Transformers on L18031 A & B or A & C phases. Pots to be connected grounded-wye on primary. Connect pots to SEL311B Vs synch check input per GDD2054_01 as Vab or Vac as appropriate. If necessary due to space constraints, remove existing 34.5 kV backfeed detection pot device on 34.5 kV L18031 and install an appropriate voltage relay on synch PT circuit to provide SCADA backfeed indication.
16. Install Transfer Trip Transmitter to isolate customer generation for an open ComEd L18031 CB or for a 94-1B3 bus trip.
17. Due to relaying constraints, L18031 shall not be tied to L18030 past SW3071 (back to TSS 180) except momentarily for switching while customer generation is in service.
18. Install Transfer Trip receiver for Received Transfer Trip from TSS 180 on L18031. Transfer trip communications circuits to be installed, maintained, and repaired in a timely manner by the customer. Customer to provide two class "A" 4 wire phone lines for this equipment. ComEd requires constant monitoring of the Transfer Trip channels via SCADA.
19. Customer to install relaying at customer site per ComEd DG book Plan C, modified as follows:
 - Customer to install a 34.5 kV circuit breaker or circuit switcher at the point of interconnection to the ComEd system capable of isolating customer's distribution facilities from the ComEd system in three cycles or less.
 - Customer to install appropriate relaying at the customer's primary breaker or circuit switcher capable of detecting all faults on the customer's 34.5 kV feeder system. Relaying is to coordinate with ComEd 's line relaying.
 - DG Book Plan C 21-1 and 32 relaying will not be required.
 - Assuming induction-type generators, synch check at the customer's site will not be required.
20. Customer relaying to be installed and maintained by customer at customer's expense.
21. ComEd to install SCADA at the customer's location per the DG book pg. 11. SCADA communications circuits to be installed, maintained, and repaired in a timely manner by the customer at customer's expense. See SCADA spec for details.
22. This plan does not cover cost for wholesale use of the distribution system.
23. Relay specs will be issued for this project.

34 kV L18031

Function	TSS 180	Oak Prairie Wind Farm
LTT, 94-1B3 TT	T	R

Notes for Plan C (Continued)

4. EX Device Type: Potential Transformer
Number Required: Depends on type of synchrocheck relay
Purpose: Provide bus voltage for synchrocheck relay
5. IN Device Type: Power Transformer
Number Required: As needed
High Voltage Connection: Delta.
6. W Device Type: Transferred Trip Transmitter
Number Required: 1
Purpose: Provide for tripping of customer breaker in the event that the source station breaker should open. May be keyed by line relaying, bus relaying or 52b contact.
7. W Device Type: Transferred Trip Receiver
Number Required: 1
Purpose: Receive transferred trip signal from source station so as to trip the customer breaker.
8. X Device Type: Breaker Failure backup tripping (i.e. LBB)
Number Required: 1 (may consist of several breakers)
Purpose: Provide for tripping of the customer generator breaker in the event that the interface breaker fails to trip. This relay to be initiated by any customer line fault relay.
9. X Device Type: Potential Transformer
Number Required: 3 connected grounded wye line side and either broken-delta or grounded-wye on secondary side.
Purpose: Provide voltage to 59G or 27 relay for faults involving ground on the ComEd system. Preferred connection is broken-delta but if feeder loading is unbalanced to the point that the 3 times zero sequence voltage is normally significant, then the secondary side should be connected grounded-wye. If this PT is to provide voltage for impedance relays or directional relays and is to be used for a 59G relay, then the PT may be 3 winding type with the third winding connected grounded-wye. Using an aux. PT (grounded-wye/broken-delta) in conjunction with PT provided by note 22 may also provide the broken-delta connection.
10. X Device Type: Over or Undervoltage Relays Device #: 59G or 27
Number Required: 1 if 59G relay or 3 if 27 relay
Purpose: Provide for tripping of customer breaker(s) via time delay in the event of a fault of ComEd system involving ground. If the PT's are connected broken-delta then the relays used is the 59G overvoltage type. If the PT's are connected grounded-wye on the secondary, then the relays used are the 27 undervoltage relays.
11. X Device Type: Fault Detector Device #: 50FD
Number Required: 1 or 3 depending on type. CT ratio is _____
Purpose: Fault Detector for 21-1 and 21-2 relays (notes 12 and 13).

Notes for Plan C (Continued)

12. N/A Device Type: Impedance Relay Device #: 21-1
Number Required: 1
Purpose: Provide for tripping of customer breaker in the event of a phase fault on the ComEd system. This relay is the Zone 1 impedance relay. This relay may be part of a stepped zone phase and ground distance relay package. If CT's are located on the low voltage side of the transformer and the PT is on the high voltage side, then this relay must receive delta current. See note 22 for required PT location. This relay may not be suitable for all locations.
13. X Device Type: Impedance Relay plus Timer Device #: 21-2/2
Number Required: 1 Impedance Relay plus 1 Timer
Purpose: Provide for tripping of customer breaker in the event of a phase fault on the ComEd system. This relay is the Zone 2 impedance relay. This relay may be part of a stepped zone phase and ground distance relay package. If CT's are located on the low voltage side of the transformer and the PT is on the high voltage side, then this relay must receive delta current. See note 22 for required PT location. This relay may be on low voltage side (using CT's and PT's located on the low voltage side) if no 21-1 relay is used. The time should be capable of providing a trip time in the .5 second to 2 seconds range.
14. X Device Type: Ground Overcurrent Relay Device #: 51G
Number Required: 1
Purpose: Provide for tripping of customer breaker in the event of a phase fault involving ground on the customer system. This relay may be in the customer neutral.
15. X Device Type: Overcurrent Relay Device #: 51
Number Required: 1
Purpose: Provide for tripping of the customer breaker in the event of a phase fault on the customer system.
16. N/A Device Type: Directional Power Relay Device #: 32
Number Required: 1 or 3 depending on type.
Purpose: Provide for tripping of the customer breaker if transformer size is smaller than generator, to limit power out if necessary to prevent damage to other customers, or to limit power out because of ComEd system constraints. This relay is not used for fault detection. This relay may be located in a CT located on the transformer secondary.
17. N/A Device Type: Synchronism Check Relay Device #: 25
Number Required: as required by the number of generator and transformer breakers needing synchrochecking. Not needed for most induction type generators.
Purpose: Provide for proper closing of breakers when customer generator(s) are to be paralleled to the ComEd system.
18. N/A Device Type: Potential Transformer
Number Required: as required for synchronism check
Purpose: Provide voltage for synchronism check relays. May be one connected phase to phase or may be part of a 3 phase potential transformer package.
19. X Device Type: Potential Transformer
Number Required: 3 connected grounded-wye/grounded-wye
Purpose: Provide voltage for under/over voltage and under/over frequency relays.

Notes for Plan C (Continued)

20. X Device Type: Under/over Frequency Relay Device #: 81U/O
Number Required: 1
Purpose: Provide tripping of customer breaker in the event the frequency fails to be maintained. This relay would be expected to operate if the customer should become isolated on the ComEd line and not be able to maintain the load. The relay should be a definite-time type with a capability of providing a trip time in the .5 second to 2 second range. A solid-state definite time type relay is recommended. The actual setting is to be determined on a case-by-case basis.
21. X Device Type: Under/over voltage relay Device #: 27/59
Number Required: depends on type
Purpose: Provide tripping of customer breaker should the feeder or line voltage not be maintained within acceptable limits. This relay should be a definite-time type or an instantaneous type with a timer. The relay should be capable of providing a trip time in the .5 second to 2 second range. The actual setting is to be determined on a case-by-case basis.
22. X Device Type: Potential Transformer
Number Required: 3 connected grounded-wye/grounded-wye
Purpose: Provide voltage for impedance relays and power directional relays. May be part of same transformer package as described in note 19.
23. X Device Type: Interrupting Device
Number Required: As needed
Purpose: May be a fuse or circuit breaker. Circuit breaker must not be dependent upon AC power for tripping.
24. X Device Type: Relay Failure Protection
Number Required: As needed
Purpose: To trip the customer generator or intertie breaker for a malfunction of protective relaying. Relays without relay failure protection shall have a back-up relay installed. This applies to 21-2, 51, 51G and 59G (or 3-phase 27). 27/59 and 81 O/U relays can rely on generator protection relaying as back-up protection (if installed).

RELAY FUNCTIONAL REQUIREMENTS
SPECIFICATIONS....PLAN C

CUSTOMER: _____

P.D.: 7P061400

SER NO.: _____

LOCATION: Nora Oak Prairie Wind Farm

DATE: 12/02/05

CONNECTED TO: 34.5 kV L18031

FIRST ISSUED: 12/02/05

THE INFORMATION BELOW IS TO BE FURNISHED BY THE CUSTOMER AND RETURNED TO COMMONWEALTH EDISON COMPANY						NOTES REFER TO "PRELIMINARY" RELAY REQUIREMENTS FOR PLAN C NOTE #	INITIATED BY RELAYS AT LEFT AS INDICATED				
DEVICE NO.	FUNCTION	TYPE*	CONN.	C.T. RATIO	P.T. RATIO		LBB	TRIP TRANS C.B.	TRIP GEN C.B.	TRIP LINE C.B.	SUPV. CLOSE
25-4	SYNCHRONISM CHECK					47					
25-2	SYNCHRONISM CHECK					47					
27/59	UNDER/OVER VOLTAGE					21					
	LBB; Relay Failure					8					
27	UNDERVOLTAGE					10					
59G	OVERVOLTAGE					10					
21-1	IMPEDANCE					12					
21-2/2	IMPEDANCE & TIMER					13					
50FD	FAULT DETECTOR					11					
32	DIRECTIONAL POWER					46					
51	OVERCURRENT					15					
51G	GROUND OVERCURRENT					14					
81	UNDER/OVER FREQ.					20					
	TRANSFER TRIP RCVR.					7					

* RELAYS SHOULD BE APPROVED BY COMED BEFORE CUSTOMER PURCHASE

ADDITIONAL NOTES: _____

RETURN TO: Jay L. Anderson
 ADDRESS: ComEd
 Relay Protection Services
 2 Lincoln Centre
 Oakbrook Terrace, IL 60181

RETURNED BY: _____
 CUSTOMER/CONSULTANT (Signature/Date)

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