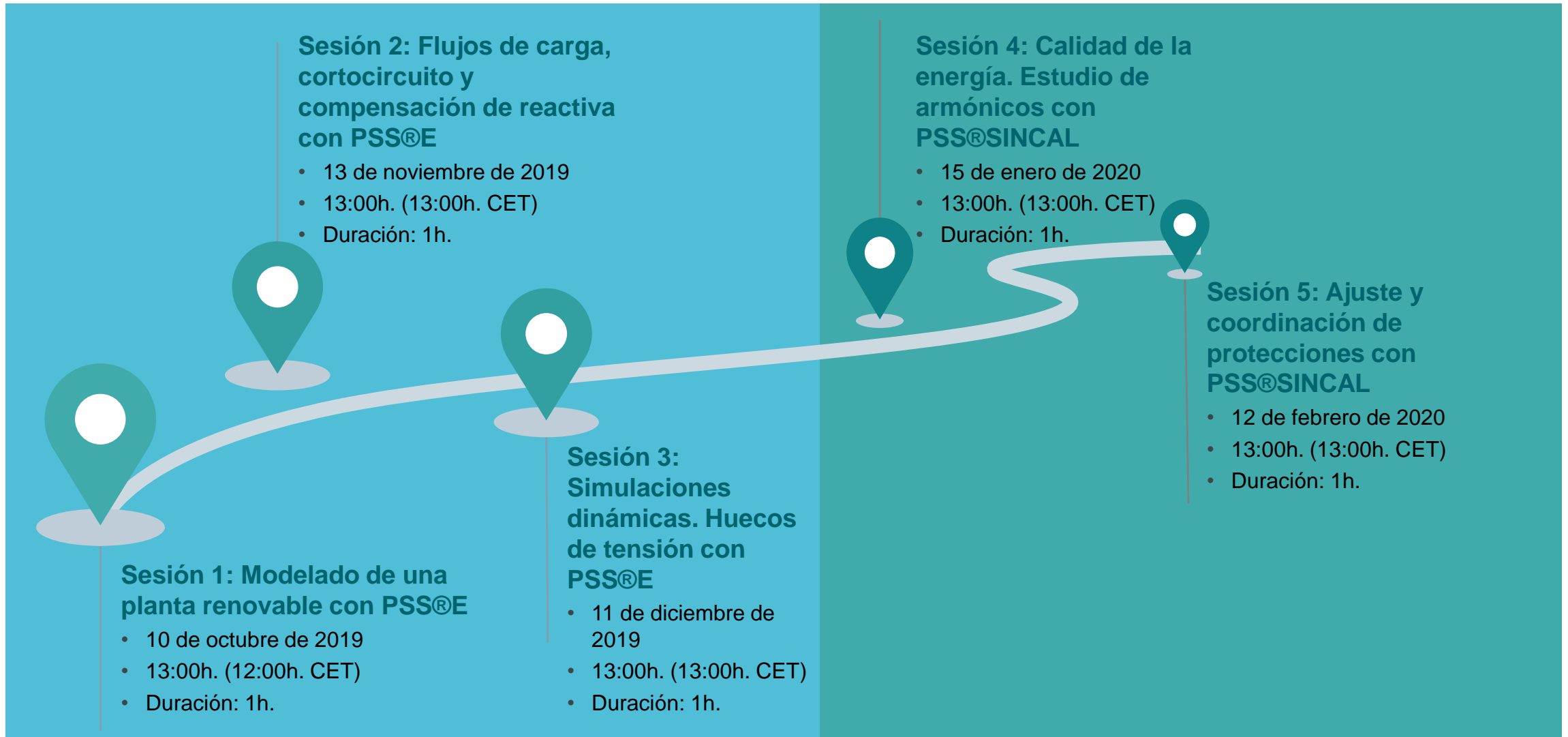


Webinar PSS

Modelado de una planta fotovoltaica en PSS/E



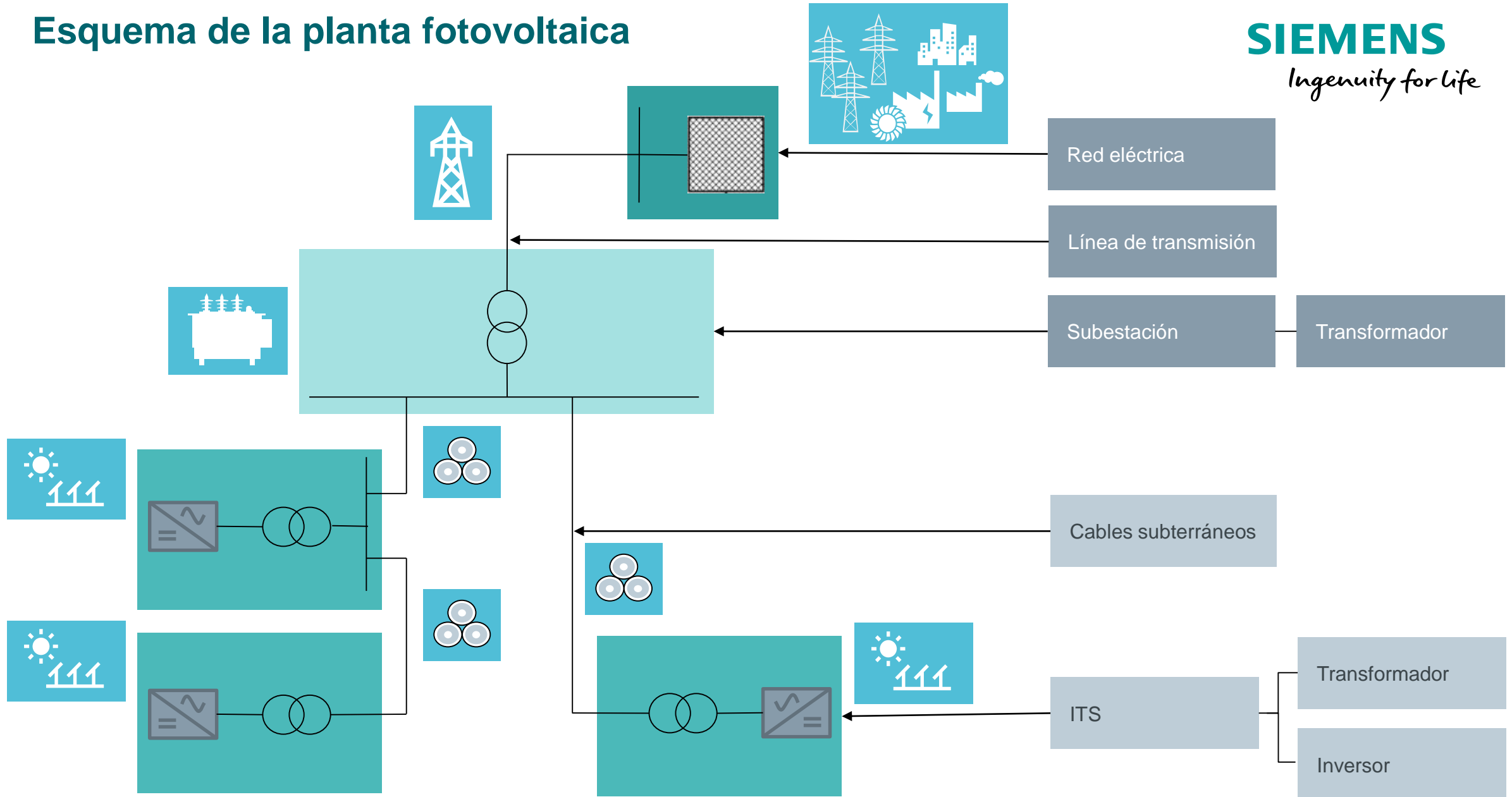
Objetivos del Webinar 1

- 1 Conocer el entorno gráfico de PSS/E

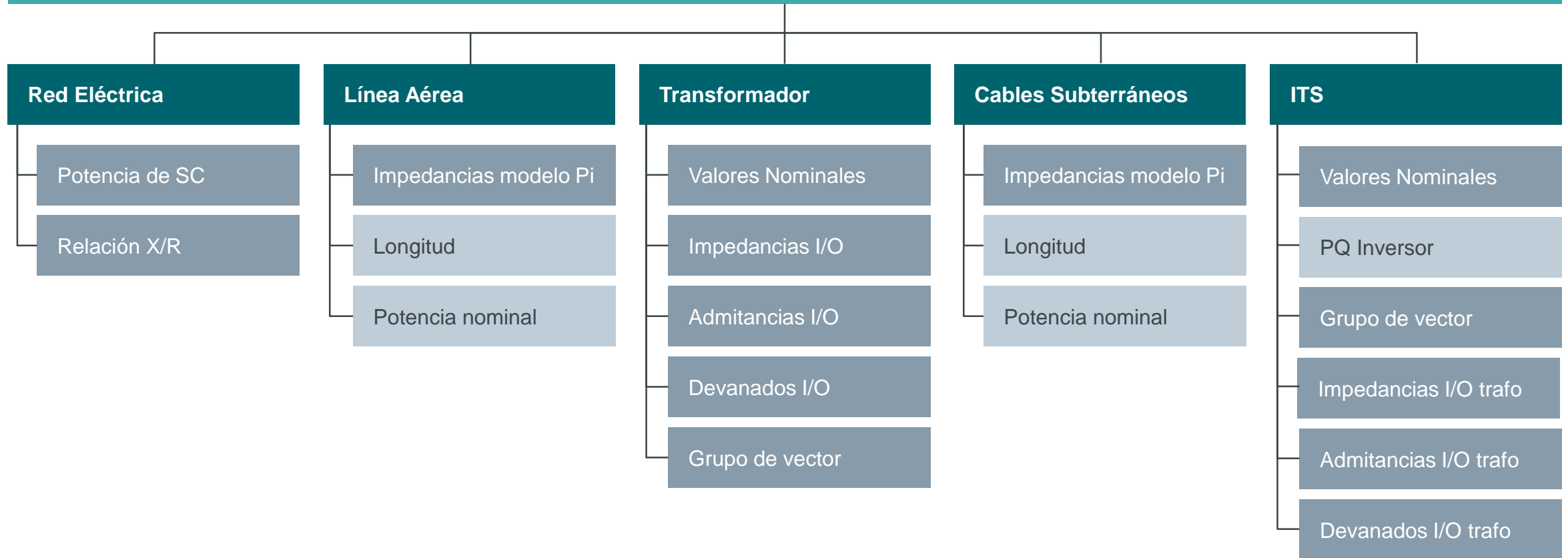
- 2 Obtener conocimiento sobre los componentes eléctricos básicos de PSS/E

- 3 Ser capaz de modelar una planta renovable en PSS/E

Esquema de la planta fotovoltaica



Modelo PSS/E



Datos de Buses



Bus Number	Section Number	Substation Number	Bus Name	Base kV	Area Num	Area Name	Zone Num	Zone Name	Owner Num	Owner Name	Code	Voltage (pu)	Angle (deg)	Normal Vmax (pu)	Normal Vmin (pu)	Emergency Vmax (pu)	Emergency Vmin (pu)
101			NUC-A	21.6	1	FLAPCO	77	PLANT	11	GEN 1	2	1.0200	16.55	1.1000	0.9000	1.1000	0.9000
102			NUC-B	21.6	1	FLAPCO	77	PLANT	11	GEN 1	2	1.0200	16.55	1.1000	0.9000	1.1000	0.9000
151			NUCPANT	500.0	1	FLAPCO	1	FIRST	1	TRAN 1	1	1.0119	10.89	1.1000	0.9000	1.1000	0.9000
152			MID500	500.0	1	FLAPCO	1	FIRST	1	TRAN 1	1	1.0171	-1.12	1.1000	0.9000	1.1000	0.9000
153			MID230	230.0	1	FLAPCO	1	FIRST	1	TRAN 1	1	0.9930	-3.24	1.1000	0.9000	1.1000	0.9000
154			DOWNTN	230.0	1	FLAPCO	1	FIRST	1	TRAN 1	1	0.9389	-9.89	1.1000	0.9000	1.1000	0.9000
201			HYDRO	500.0	2	LIGHTCO	2	SECOND	22	GEN 2	1	1.0400	6.16	1.1000	0.9000	1.1000	0.9000
202			EAST500	500.0	2	LIGHTCO	2	SECOND	2	TRAN 2	1	1.0088	-1.32	1.1000	0.9000	1.1000	0.9000

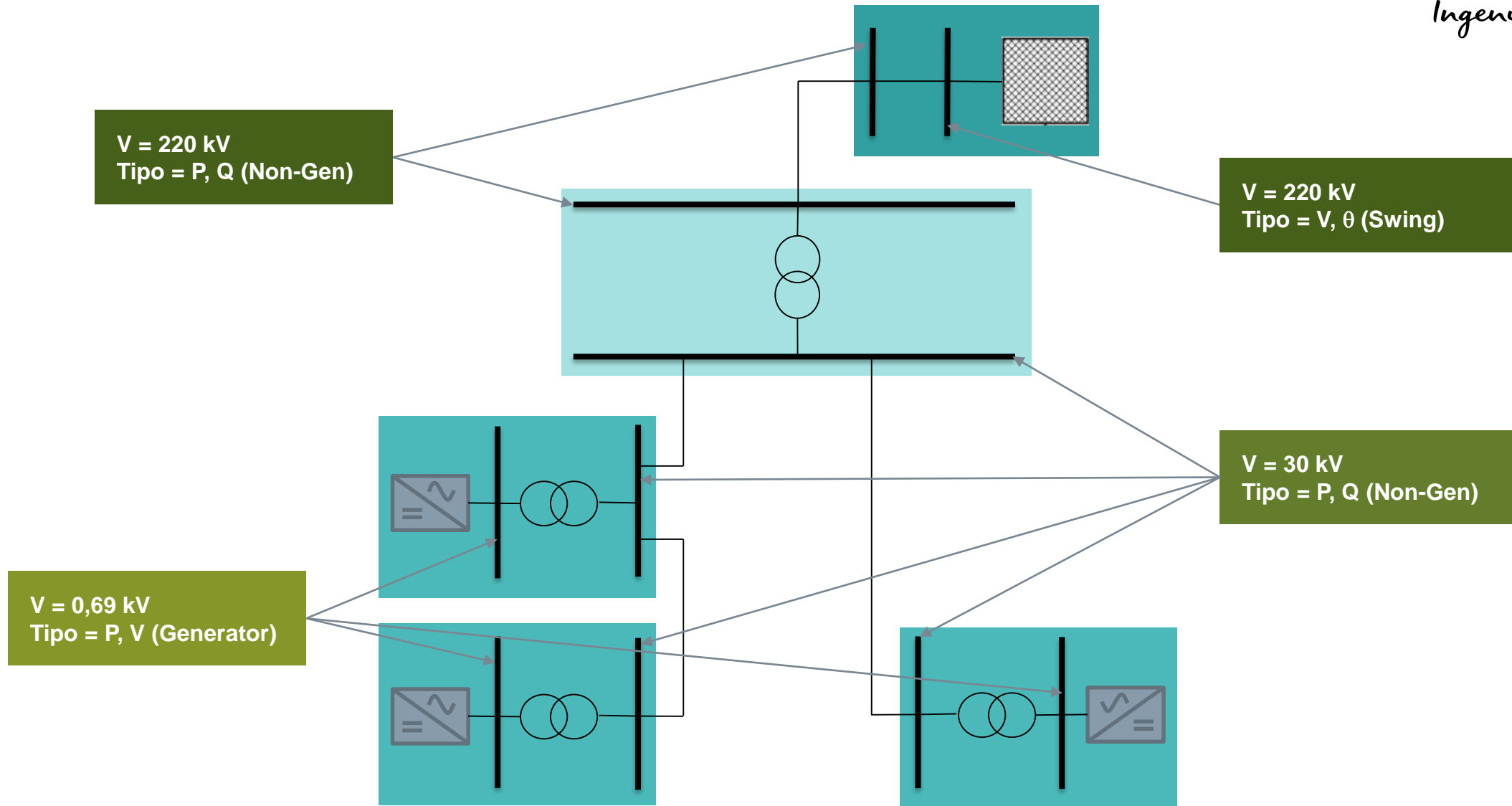
Bus Plant Machine Load Fixed Shunt Switched Shunt Induction Machine NCSFCC /
 Buses and Equipment Branch Node-Breaker Other /

Tipo	Especificado	Calculado	Descripción
1	P, Q	V, θ	Buses con cargas o sin nada
2	P, V	Q, θ	Buses con generación
3	V, θ	P, Q	Bus swing (o slack) del sistema
4	No	No	Desconectado

Datos de Buses

Tipo	Especificado	Calculado	Descripción
1	P, Q	V, θ	Buses con cargas o sin nada
2	P, V	Q, θ	Buses con generación
3	V, θ	P, Q	Bus swing (o slack) del sistema
4	No	No	Desconectado

Datos de Buses



Datos línea de transmisión

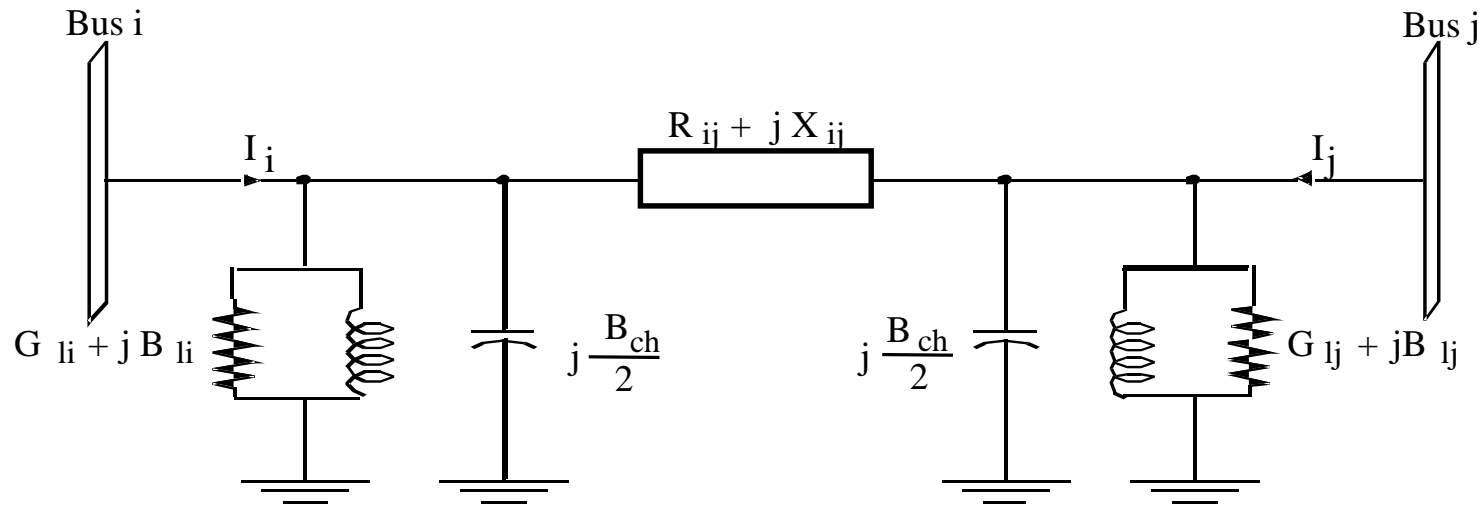
From Bus Number	From Bus Name	To Bus Number	To Bus Name	Id	Name	Term Node Num (From)	Term Node Name (From)	Term Node Num (To)	Term Node Name (To)	Line R (pu)	Line X (pu)	Charging B (pu)	In Service	Metered	Line G From (pu)	
151	NUCPANT	500.0	152	MID500	500.00	1		0		0.002600	0.04600	3.500000	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	From	0.00000
151	NUCPANT	500.0	152	MID500	500.00	2		0		0.002600	0.04600	3.500000	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	From	0.00000
151	NUCPANT	500.0	201	HYDRO	500.00	1		0		0.001000	0.01500	1.200000	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	From	0.00000
152	MID500	500.00	202	EAST500	500.00	1		0		0.000800	0.01000	0.950000	<input checked="" type="checkbox"/>	<input type="checkbox"/>	From	0.00000

AC Line / 2 Winding / 3 Winding / Mutual / System Switching Device / Multi-section line / 2-Term DC / VSC DC / N-Term DC / FACTS / GNE /
Buses and Equipment / Branch / Node-Breaker / Other

From Bus Number	From Bus Name	To Bus Number	To Bus Name	Line B From (pu)	Line G To (pu)	Line B To (pu)	RATE1 (l as MVA)	RATE2 (l as MVA)	RATE3 (l as MVA)	Length	Owner 1	Fraction 1
151	NUCPANT	500.0	152	MID500	500.00	0.00000	1200.0	1300.0	1.0	0.000	1	1.000
151	NUCPANT	500.0	152	MID500	500.00	0.00000	1200.0	1300.0	1.0	0.000	1	1.000
151	NUCPANT	500.0	201	HYDRO	500.00	0.00000	1200.0	1300.0	1.0	0.000	1	1.000
152	MID500	500.00	202	EAST500	500.00	0.00000	1200.0	1300.0	1.0	0.000	1	1.000

AC Line / 2 Winding / 3 Winding / Mutual / System Switching Device / Multi-section line / 2-Term DC / VSC DC / N-Term DC / FACTS / GNE /
Buses and Equipment / Branch / Node-Breaker / Other

Modelo equivalente en Pi de la línea



Datos línea de transmisión

Branch Data Record

Power Flow | Short Circuit

Basic Data

From Bus Number: 153 | From Bus Name: MID230 230.00 | In Service

To Bus Number: 154 | To Bus Name: DOWNTN 230.00 | Metered on From end

Branch ID: 2 | Branch Name:

Branch Data

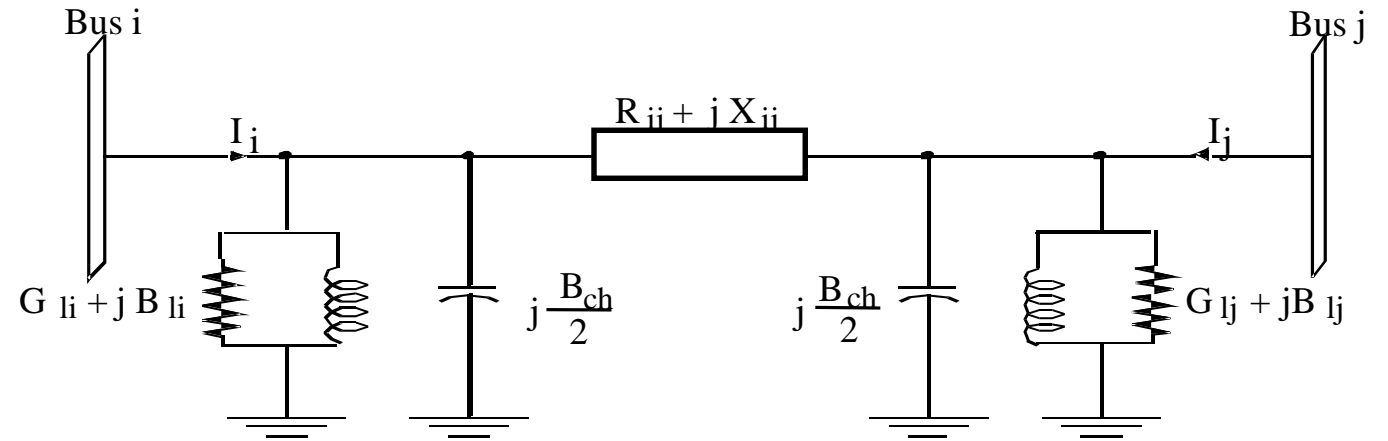
Line R (pu): 0,006000	Line X (pu): 0,054000	Ratings (I as MVA)
Charging B (pu): 0,150000	Length: 0,000	
Line G From (pu): 0,00000	Line B From (pu): 0,00000	
Line G To (pu): 0,00000	Line B To (pu): 0,00000	

Owner Data

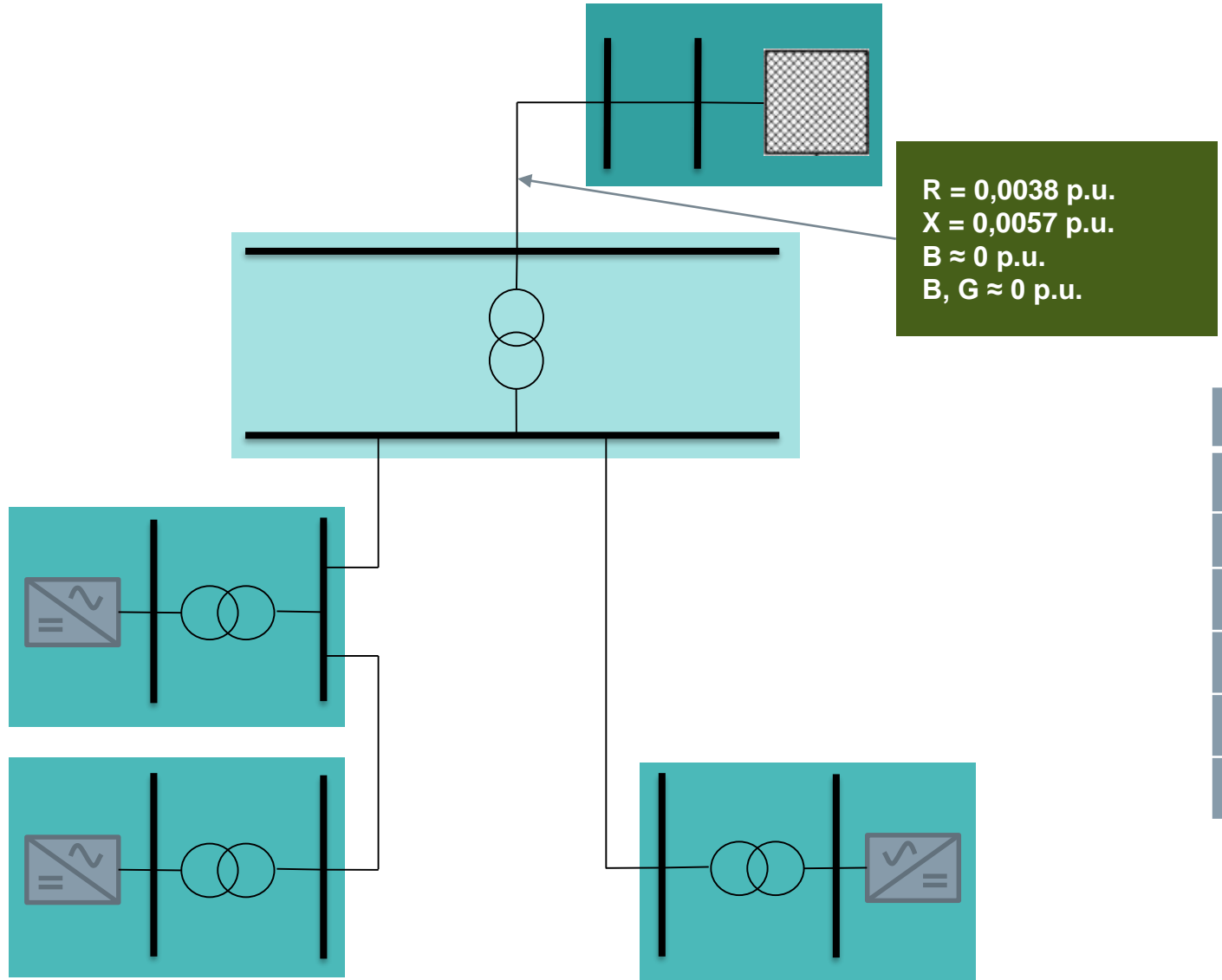
Owner	Fraction
1 Select ...	1,000
0 Select ...	1,000
0 Select ...	1,000
0 Select ...	1,000

OK | Cancel

Modelo equivalente en Pi de la línea



Datos línea de transmisión

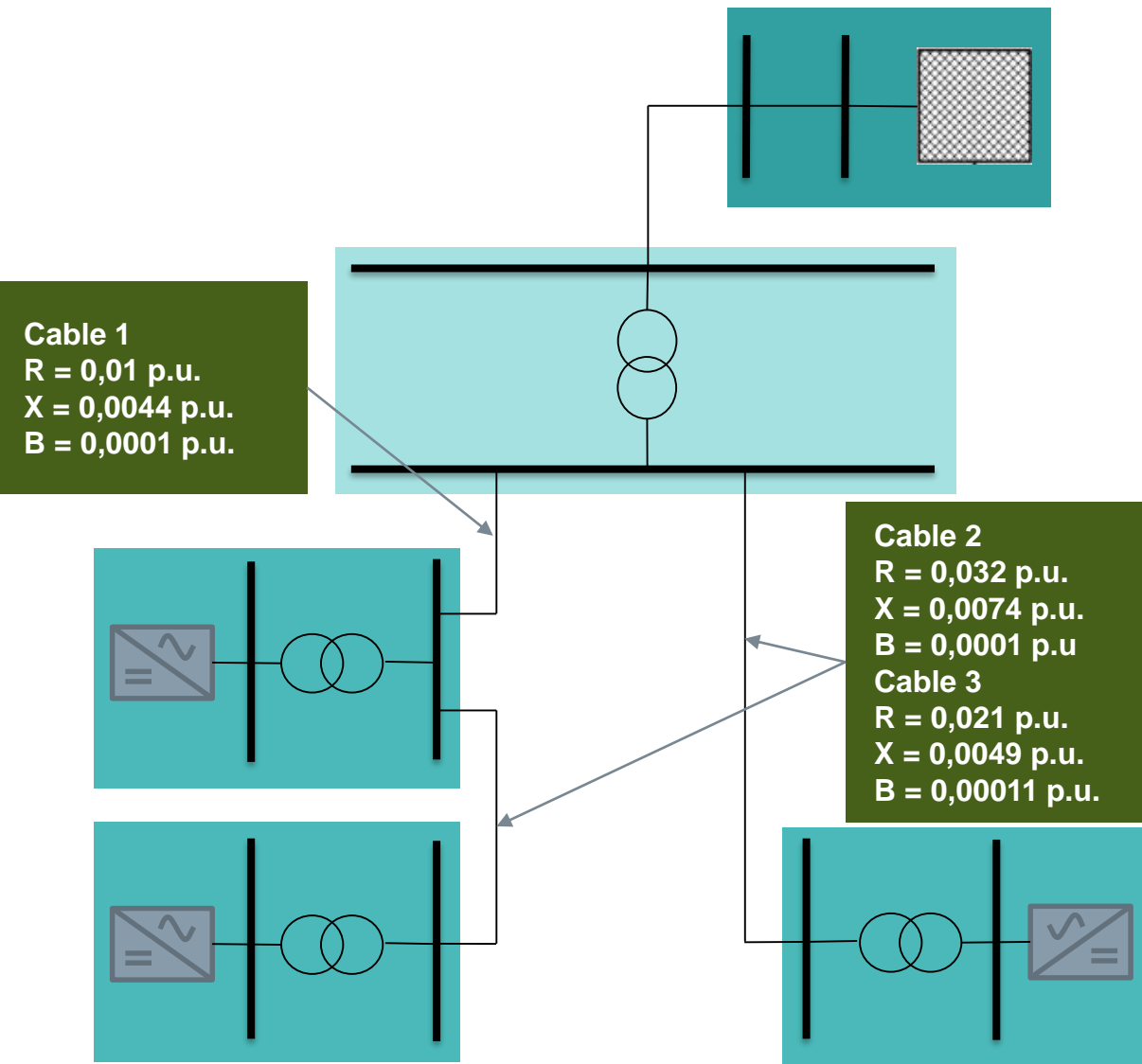


Dato	Valor
MBASE	100 MVA
Frecuencia	50 Hz
Tensión	220 kV
Longitud	12,3 km
R/km	0,15 Ω
L/km	0,72 mH

$$\frac{R}{\text{km}} \frac{l}{V^2} \frac{l}{MVA}$$

$$\frac{2\pi f \cdot L}{\text{km}} \frac{l}{V^2} \frac{l}{MVA}$$

Datos cables subterráneos



Dato	Valor
MBASE	100 MVA
Frecuencia	50 Hz
Tensión	30 kV
Tipo Cable 1	3x1 XLPE 95 mm ²
Tipo Cable 2, 3	3x1 XLPE 50 mm ²
Longitud Cable 1	0,3 km
Longitud Cable 2	0,45 km
Longitud Cable 3	0,25 km.
R ₁ /km	0,320 Ω
L ₁ /km	0,422 mH
C ₁ /km	0,167 μF
R _{2,3} /km	0,641 Ω
L _{2,3} /km	0,475 mH
C _{2,3} /km	0,139 μF

$$\frac{R}{\text{km}} \frac{l}{V^2} \frac{1}{\text{MVA}}$$

$$\frac{2\pi f \cdot L}{\text{km}} \frac{l}{V^2} \frac{1}{\text{MVA}}$$

$$\frac{2\pi f \cdot C}{\text{km}} \frac{l}{V^2} \frac{1}{\text{MVA}}$$

Datos de Transformador

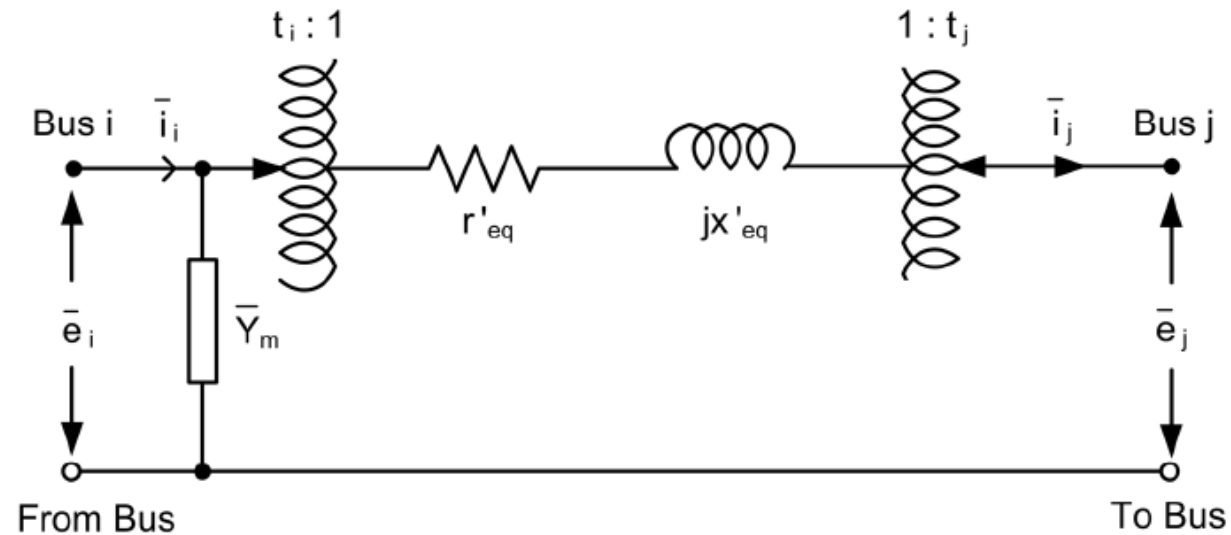


From Bus Number	From Bus Name	To Bus Number	To Bus Name	Id	Name	Term Node Num (From)	Term Node Name (From)	Term Node Num (To)	Term Node Name (To)	In Service	Metered	Winding 1 Side	Controlled Bus	Controlled Side	Tap Positions
101	NUC-A	21.600	151	NUCPANT	500.0	1		0		<input checked="" type="checkbox"/>	<input type="checkbox"/> From	<input type="checkbox"/> From	0	<input type="checkbox"/> Tapped	5

Control Mode	Auto Adjust	Winding I/O Code	Impedance I/O Code	Admittance I/O Code	Specified R (pu or watts)	Specified X (pu)	RATE1 (MVA)	RATE2 (MVA)	RATE3 (MVA)	Magnetizing G	Magnetizing B	Owner	Fraction
None	<input type="checkbox"/> Yes	Turns ratio (pu on bus bas	Zpu (system ba	Y pu (system ba	0.000300	0.013600	1250.0	1350.0	1750.0	0.00000	0.00000	1	1.000

Owner 2	Fraction 2	Owner 3	Fraction 3	Owner 4	Fraction 4	Winding MVA Base	Wnd 1 Ratio (pu or kV)	Wnd 1 Nominal kV	Wnd 1 Angle (degrees)	Wnd 2 Ratio (pu or kV)	Wnd 2 Nominal kV	Rmax (pu, kV, deg)	Rmin (pu, kV, deg)	Vmax (pu, Mvar, MW)
0	1.000	0	1.000	0	1.000	100.0000	1.0000	0.0000	0.00	1.0000	0.0000	1.10000	0.90000	1.10000

Vmin (pu, Mvar, MW)	Wnd Connect Angle (deg)	Load Drop Comp R (pu)	Load Drop Comp X (pu)	Impedance table	R (table corrected)	X (table corrected pu)
0.90000	0.00000	0.00000	0.00000	0	0.00030	0.01360



Datos de Transformador



Two Winding Transformer Data Record

Power Flow | Short Circuit

Line Data

From Bus Number: 101 From Bus Name: NUC-A 21.600 In Service

To Bus Number: 151 To Bus Name: NUCPANT 500.00 Metered on From end

Branch ID: Transformer Name: Winding 1 on From end

Vector Group:

I/O Data

Winding I/O Code: 1 - Turns ratio (pu on bus base kV) Impedance I/O Code: 1 - Z pu (winding kV system MVA) Admittance I/O Code: 1 - Y pu (system base)

Transformer Impedance Data

Specified R (pu)	Specified X (pu)
0,000300	0,013600
Magnetizing G (pu)	Magnetizing B (pu)
0,00000	0,00000
Impedance Table	
0	
R table corrected (pu)	X table corrected (pu)
0,00030	0,01360

Transformer Nominal Ratings Data

Winding 1 Ratio (pu)	Winding 1 Nominal kV	Ratings (MVA)
1,0000	0,0000	RATE1 1250,0
Winding 2 Ratio (pu)	Winding 2 Nominal kV	RATE2 1350,0
1,0000	0,0000	RATE3 1750,0
Winding (1-2) Angle (degrees)	Winding MVA	RATE4 0,0
0,00	100,0000	

Control Data

Controlled Bus Number: 0 Controlled Bus Name: Control Mode: 0 - None

Controlled Bus On Winding Side Auto Adjust

Tap Positions: 5 Wnd Connect Angle: 0,00000

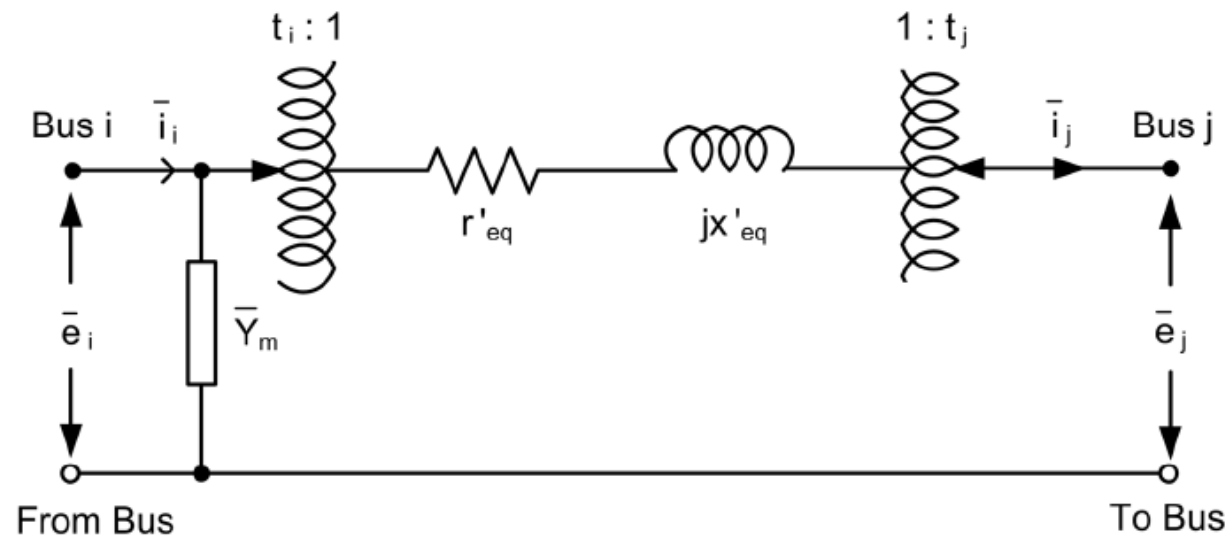
R1max (pu): 1,10000 R1min (pu): 0,90000

Vmax (pu): 1,10000 Vmin (pu): 0,90000

Load Drop Comp Load Drop Comp R (pu): 0,00000

Load Drop Comp X (pu): 0,00000

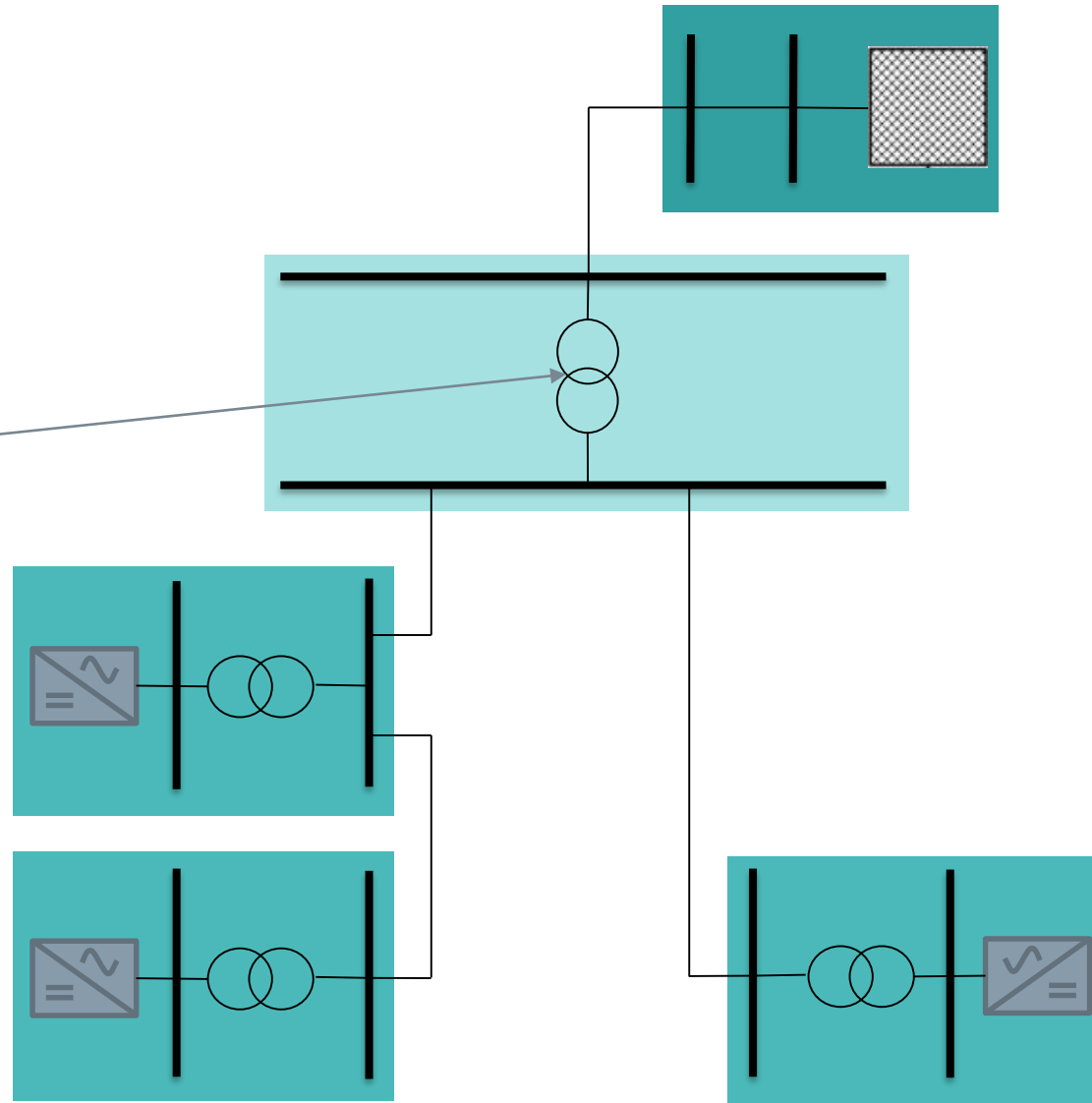
OK Cancel



Datos de Transformador

Potencia = 20 MVA
Load loss = 100 kW
 $Z = 0,1$ p.u. (10%)
No load loss = 20 kW
I excitación = 0,007 p.u. (0,7%)

Cambiador de tomas:
5 taps, $\pm 2,5\%$, $\pm 5\%$

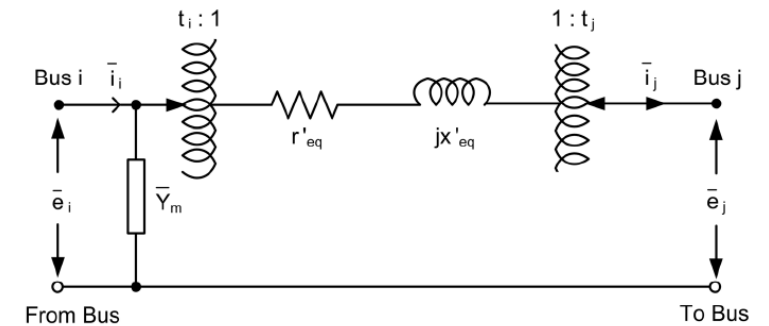
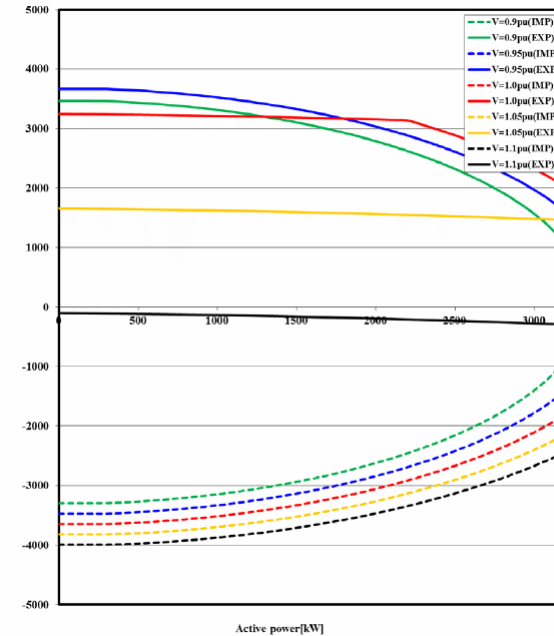


Datos de ITS

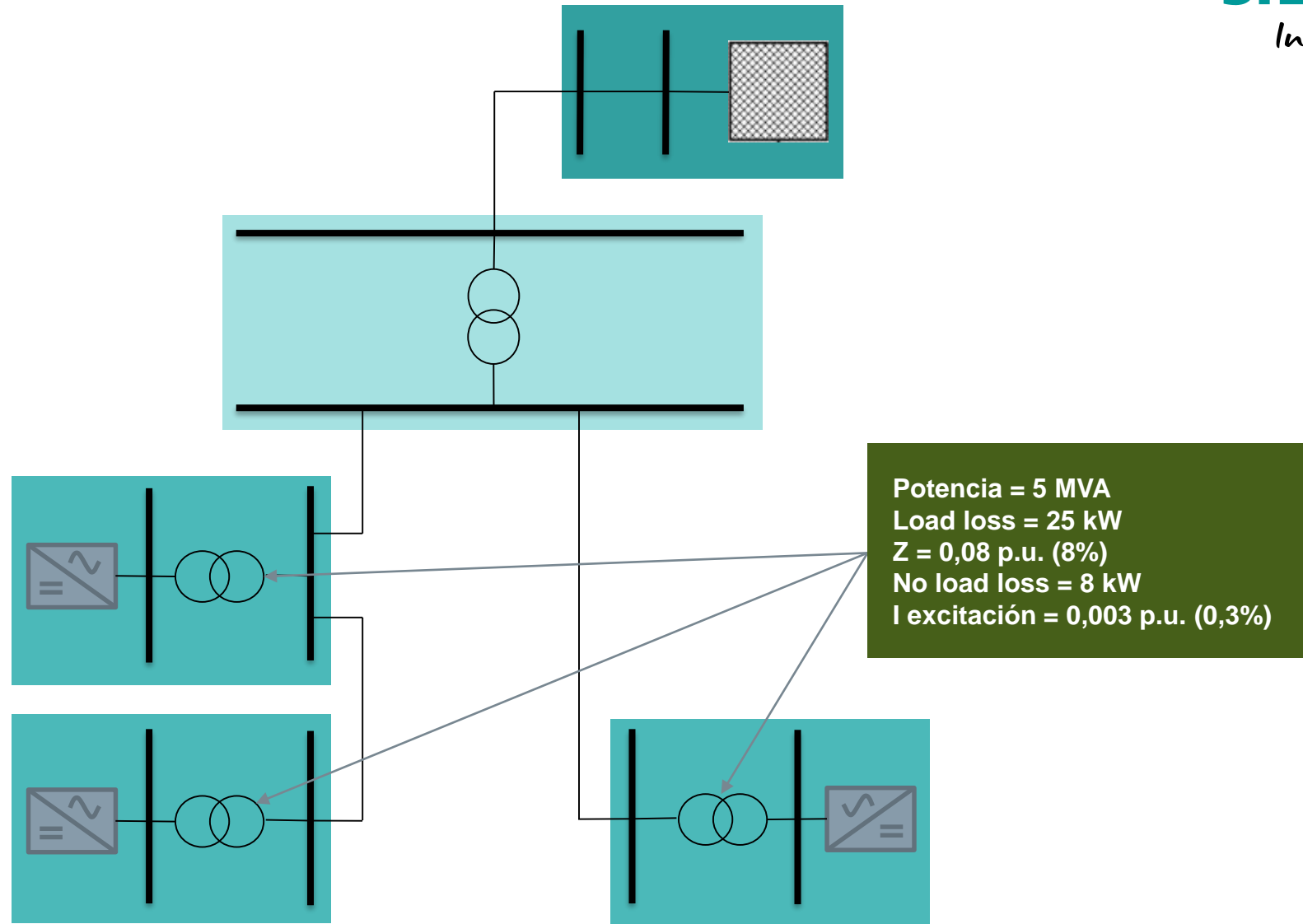
1 Máxima P y S nominal

2 Curva PQ

3 Datos de transformador



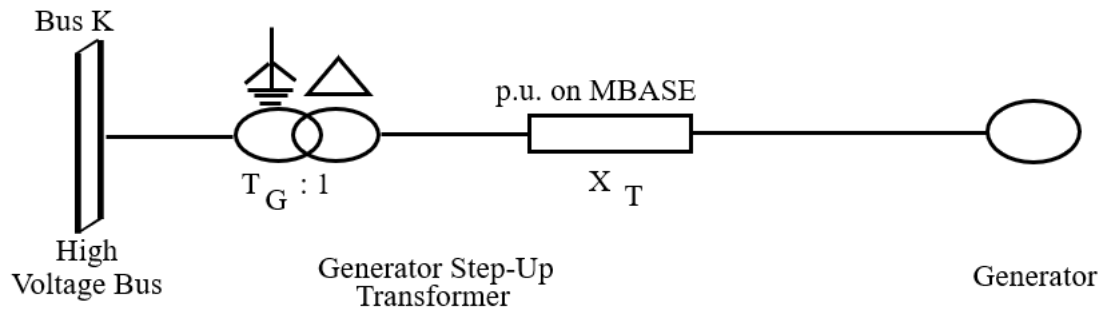
Datos de Transformador ITS



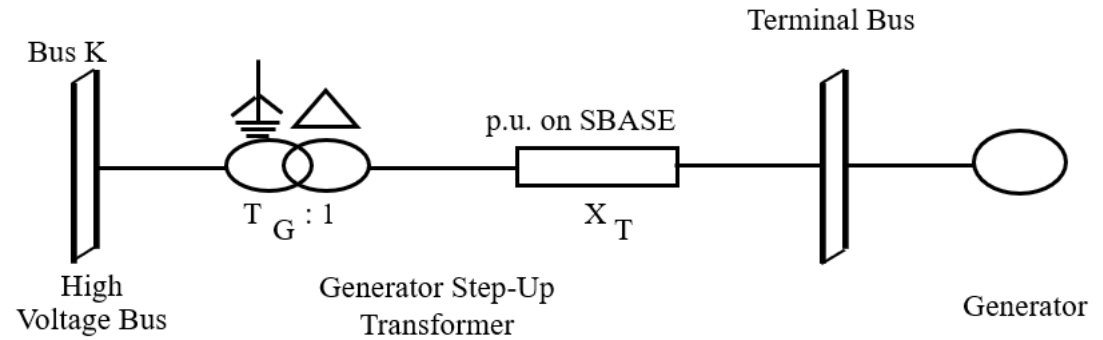
Datos de inversor

Bus Number	Bus Name	Id	Term Node Num	Term Node Name	Area Num	Area Name	Zone Num	Zone Name	Code	VSched (pu)	Remote Bus	In Service	PGen (MW)	PMax (MW)	PMin (MW)	QGen (Mvar)	QMax (Mvar)	QMin (Mvar)	Mbase (MVA)
101	NUC-A	21.600	1	0	1	FLAPCO	77	PLANT	2	1.0200	0	<input checked="" type="checkbox"/>	750.0000	810.000	0.0000	81.193	600.000	-100.00	900.00
102	NUC-B	21.600	1	0	1	FLAPCO	77	PLANT	2	1.0200	0	<input checked="" type="checkbox"/>	750.0000	810.000	0.0000	81.193	600.000	-100.00	900.00
206	URBGEN	18.000	1	0	2	LIGHTCO	2	SECOND	-2	0.9800	205	<input checked="" type="checkbox"/>	800.0000	900.000	0.0000	600.00	600.000	0.0000	1000.00
211	HYDRO_G	20.00	1	0	2	LIGHTCO	2	SECOND	2	1.0400	201	<input checked="" type="checkbox"/>	600.0000	616.250	0.0000	17.749	400.000	-100.00	725.00
3011	MINE_G	13.800	1	0	5	WORLD	5	FIFTH	3	1.0400	0	<input checked="" type="checkbox"/>	258.6571	900.000	0.0000	104.04	600.000	-100.00	1000.00

Bus Plant **Machine** Load Fixed Shunt Switched Shunt Induction Machine NCSFCC /
Buses and Equipment Branch Node-Breaker Other /



Modelo para transformador implícito



Modelo para transformador explícito

Datos de inversor

Machine Data Record

Power Flow | Short Circuit

Basic Data

Bus Number: 3011 Bus Name: MINE_G 13.800

Machine ID: In Service Bus Type Code: 3

Machine Data

Pgen (MW)	Pmax (MW)	Pmin (MW)
<input type="text"/> 258,6357	<input type="text"/> 900,0000	<input type="text"/> 0,0000
Qgen (Mvar)	Qmax (Mvar)	Qmin (Mvar)
<input type="text"/> 103,6111	<input type="text"/> 600,0000	<input type="text"/> -100,0000
Mbase (MVA)	R Source (pu)	X Source (pu)
<input type="text"/> 1000,00	<input type="text"/> 0,010000	<input type="text"/> 0,350000

Transformer Data

R Tran (pu)
<input type="text"/> 0,00000
X Tran (pu)
<input type="text"/> 0,00000
Gentap (pu)
<input type="text"/> 1,00000

Owner Data

Owner	Fraction
<input type="text"/> 55 <input type="button" value="Select ..."/>	<input type="text"/> 0,385
<input type="text"/> 5 <input type="button" value="Select ..."/>	<input type="text"/> 0,308
<input type="text"/> 22 <input type="button" value="Select ..."/>	<input type="text"/> 0,231
<input type="text"/> 11 <input type="button" value="Select ..."/>	<input type="text"/> 0,077

Wind Data

Control Mode: 0 - Not a wind machine

Power Factor (WPF): 1,000

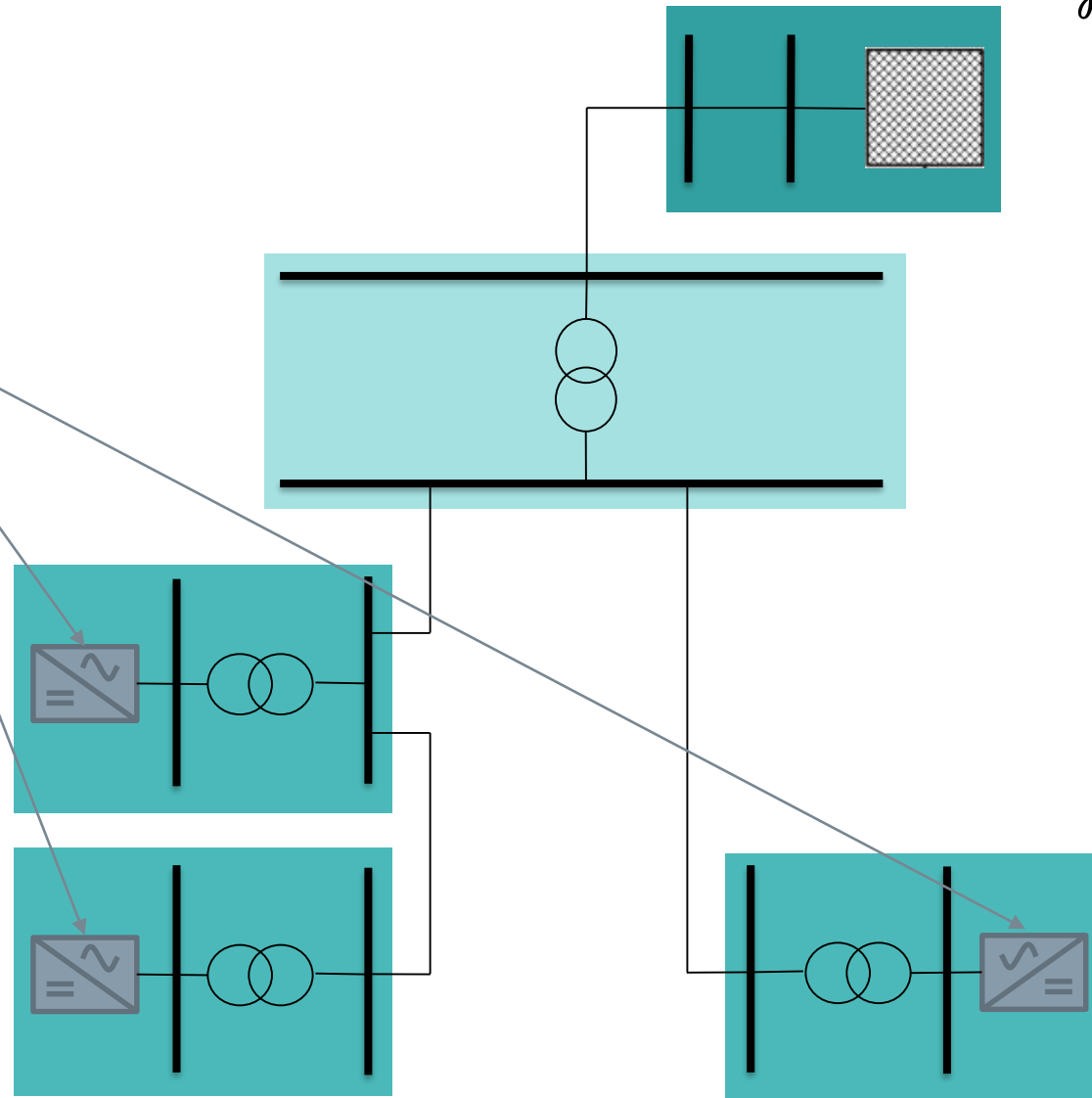
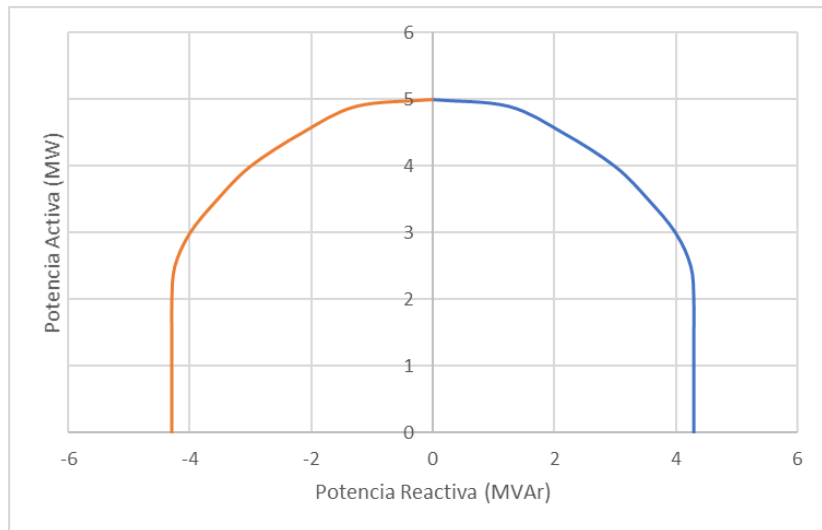
Plant Data

Sched Voltage	Remote Bus
<input type="text"/> 1,0400	<input type="text"/> 3011

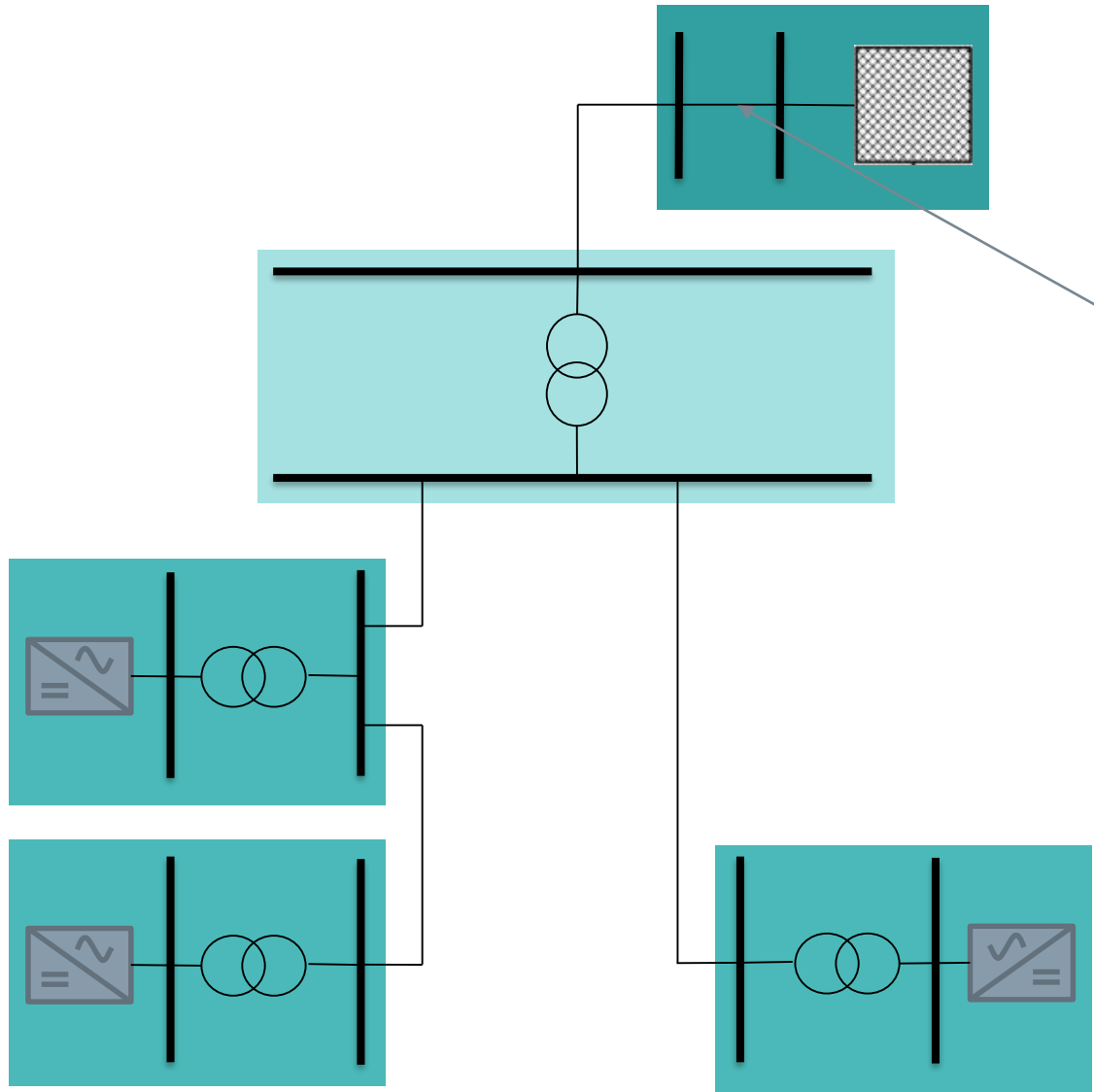
OK Cancel

Datos de Transformador ITS

**MBASE = 5 MVA
Potencia Máx. = 5 MW
Potencia Min. = 0 MW**



Datos de la red



X = 0,0488 p.u.
R = 0,0048 p.u.

Dato	Valor
MBASE	100 MVA
Tensión	220 kV
I_{sc}	9,3 kA
X/R	10
R	2,365 Ω
X	23,656 Ω



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Spain

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[siemens.com/power-technologies](https://www.siemens.com/power-technologies)