Electricity Coordinating Center Ltd

Elektroenergetski koordinacioni centar d.o.o.

TNA

general software presentation

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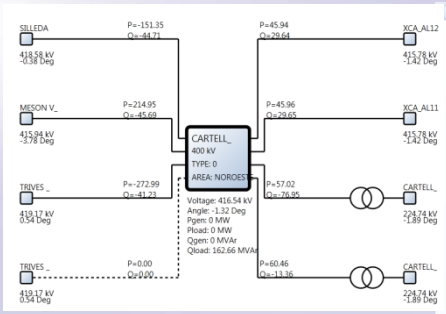
TNA - General

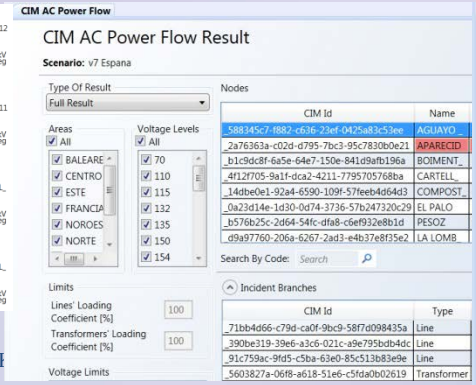
Transmission Network Analyzer in development since 2009, by EKC and SE DMS

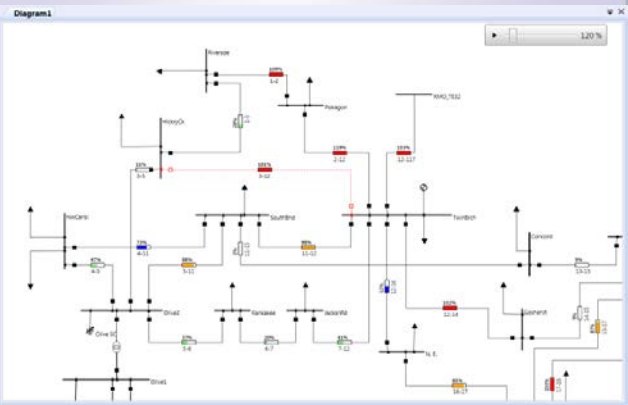
TNA provides analytic and short-term planning functions, suitable for TSOs and RCCs

- Calculation of static load flow (AC, DC)
- Contingency analyses (n-1, n-x), Remedial Actions
- Automatic transmission capacity calculation: NTC, Flow-based (PTDF/RAM)
- Day Ahead Congestion Forecast (DACF) procedure, D2CF, IDCF
- Network models building, validation, merging, conversion (UCTE, RAW, CIM/CGMES)
- Sensitivity analyses (zonal, nodal PTDF, OTDF, PSDF, DCDF, PFC, FLD)
- Statistics (contingencies, losses)
- Short circuit analyses

TNA obtained CGMES format Conformity Attestation (gold), by ENTSO-E (2015)





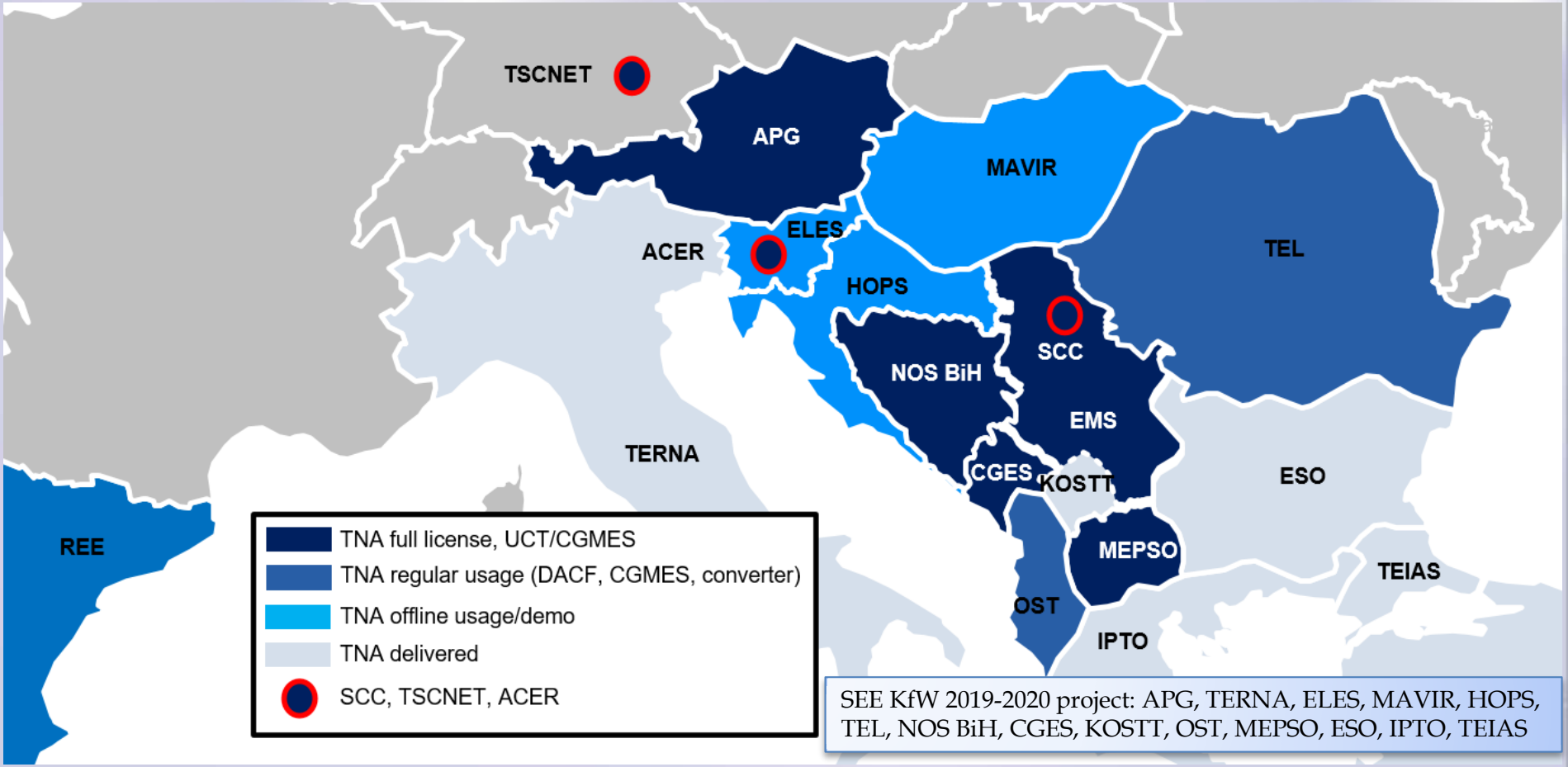


TNA - Beneficiaries

TSOs: TNA is provided to 16 TSOs in Continental Europe, in everyday usage by 8 TSOs (APG, CGES, EMS, MEPSO, NOSBiH, OST, REE, Transelectrica)

RCCs: SCC Belgrade (primary tool), TSCNET Munich (secondary tool), *CORESO (PFC function)*

Regulators: ACER Ljubljana, delivery projects 2017 and 2019



TNA –CGMES

Attestation of Conformity: **Gold**

ENTSO-E, Brussels June 2015

Standard		Bronze
Profile	Equipment Boundary	Gold
Profile	Topology Boundary	Gold
Profile	Equipment core	Gold
Profile	Equipment short circuit	Gold
Profile	Equipment operation	Gold
Profile	Topology	Gold
Profile	Steady State Hypothesis	Gold
Profile	State Variables	Gold
Profile	Dynamics	n/a
Profile	Diagram Layout	Gold
Profile	Geographical Location	Gold
Function	Import	Gold
Function	Export	Gold
Function	Update and Repository	Gold
Function	Diagram Layout	Gold
Function	Geographical (GIS) location	Gold
Function	Load Flow (Node-breaker input representation)	Gold
Function	Load flow (Bus-branch input representation)	Gold
Function	Dynamics	n/a
Function	Short circuit	Gold

European Network of Transmission System Operators For Electricity

entsoe

ATTESTATION OF CONFORMITY

Date of issue: 08 June 2015

Attestation number: 2014/08/001

The European Network of Transmission System Operators for Electricity (ENTSO-E), hereby declares that, in accordance with the section 5.1.2 of the CGMES Conformity Assessment Framework adopted on 11 April 2014, a second party assessment has been performed for the Application:

Transmission Network Analyser
Version 2

for which an Attestation of Conformity was sought by Schneider Electric DMS NS D.O.O., a company registered in Serbia with registered offices at Narodnog fronta 25 A, B, C, D, Novi Sad, Serbia (corporate number 20422882) and Electricity Coordinating Center D.O.O., a company registered in Serbia with registered offices at Vojvode Stepe 412, PO Box 50, 11040 Belgrade, Serbia (corporate number 06971121).

ENTSO-E declares that the Opinion Body issued a positive opinion on the Conformity of the Application (Declaration of Conformity 05/12/2014) with the requirements of the Common Grid Model Exchange Standard (CGMES) version 2.4.15, the Conformity Assessment Scheme version 1.1.1 and asked the Assessment Body to issue this Attestation of Conformity for the following CGMES conformity levels:

In accordance with the section 5.1.2.2 of the CGMES Conformity Assessment Framework, this Attestation of Conformity shall be valid for the full lifetime of this specific version of the Application, unless withdrawn in accordance with the procedure described in section 6.2 of the CGMES Conformity Assessment Framework.

For the avoidance of doubt, this Attestation of Conformity reflects the opinion of the Opinion Body on the Conformity of the Application with the requirements of the CGMES but cannot be regarded as granting any right or obligation of any kind towards third parties.

Brussels, 9/6/15
Place, Date

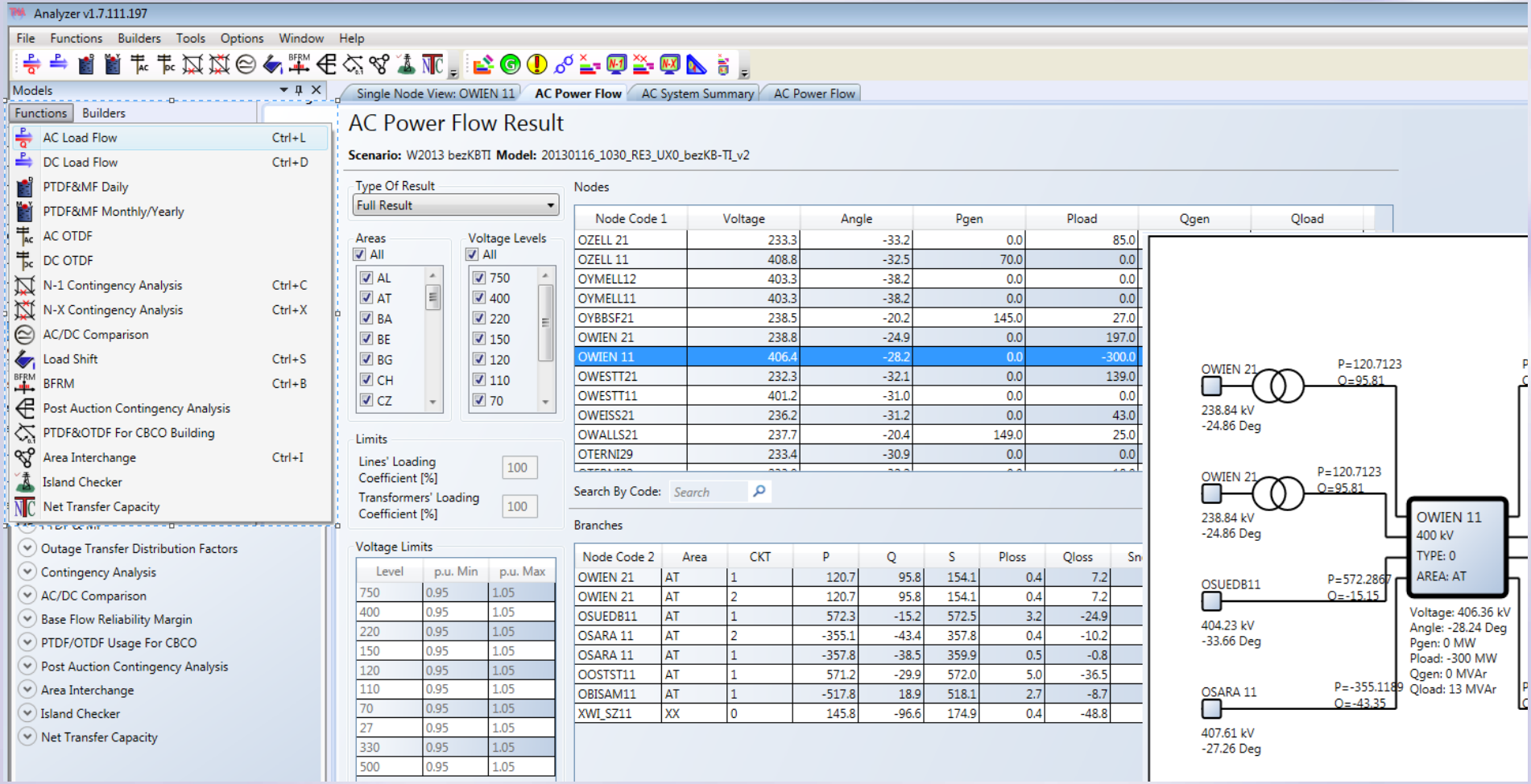
Konstantin Staschus, Secretary General

CGMES Conformity Assessment Body • cgmes.conformity@entsoe.eu • www.entsoe.eu
ENTSO-E AISBL • Avenue de Cortenbergh 100 • 1000 Brussels • Belgium • Tel + 32 2 741 09 50 • Fax + 32 2 741 09 51

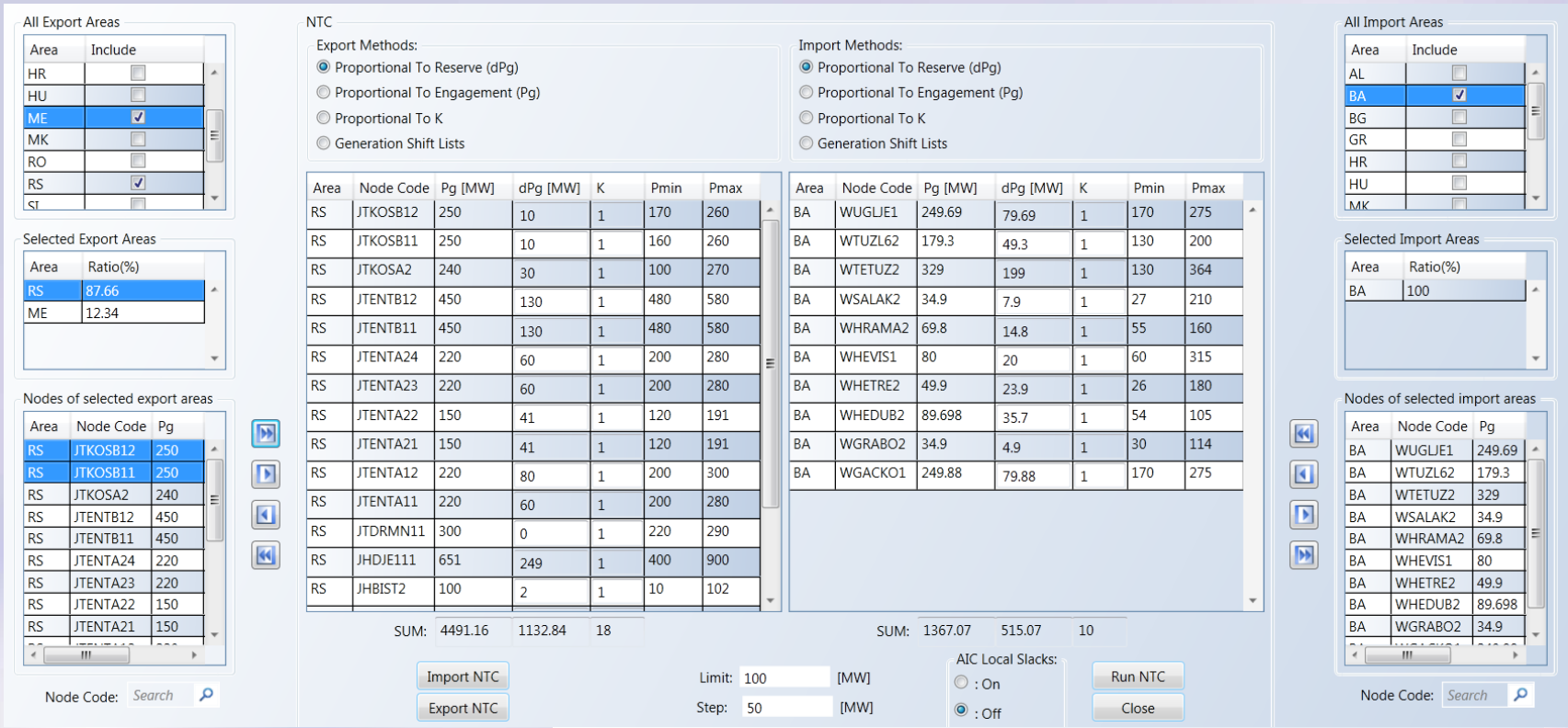
TNA 2.3 Functionalities:

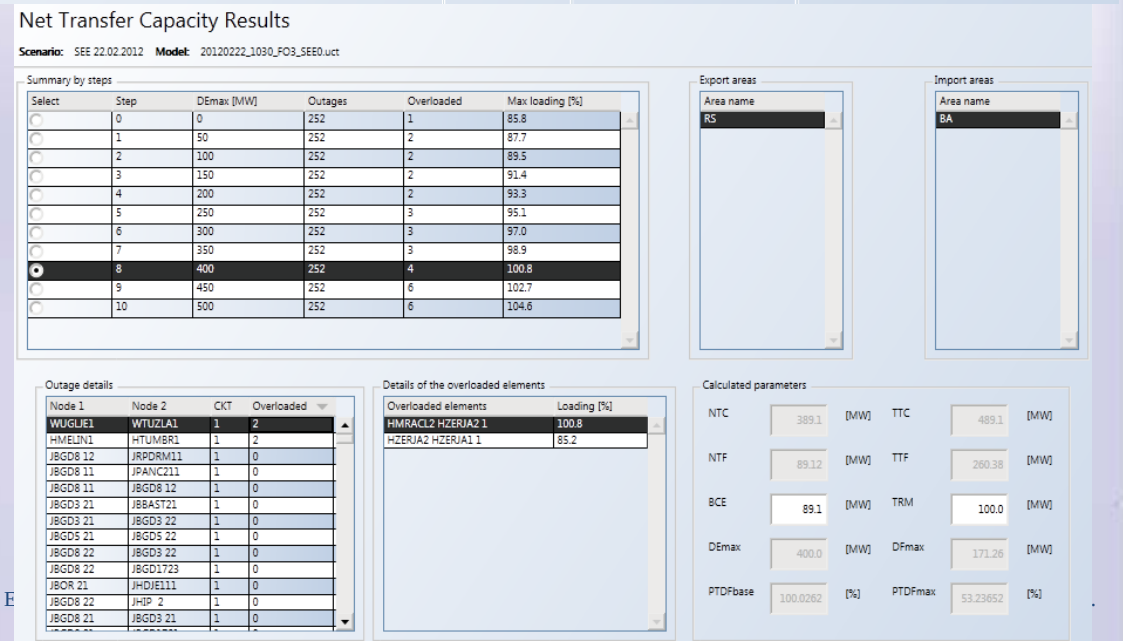
TNA functionality	Type
AC Load Flow	Function
DC Load Flow	Function
Area Interchange	Function
Contingency: n-x (AC, DC)	Function
OTDF (AC, DC)	Function
Island Checker	Function
Network reduction	Function
Network equivalent	Function
Generation&Load shift	Function
NTC calculation, single	Function
Flow-based calculation (PTDF/RAM)	Function
PTDF/OTDF usage for CB/CO filtering	Function
Nodal PTDF	Function
Power Flow Colouring/Decomposition (PFC, FLD)	Function
DACF/D2CF/IDCF procedure	Function
NTC calculation, 24 hours (embedded in D2/DACF/ID)	Function
Short circuit (fault) calculation	Function
Contingency Builders	Builder
Monitoring Builders	Builder
Model Builder	Builder
CRAC builder	Builder
Graphical Builder	Builder
GSK Builder (for FB)	Builder
CBCO builder (for FB)	Builder
API functionality	Tool
Models validation & merging	Tool
Statistics: model validation	Tool
Statistics: losses	Tool
Statistics: contingency	Tool
Models conversion CGMES/UCT/RAW	Tool
Floating License Server (FLS)	Tool

TNA 2.3 Load flow

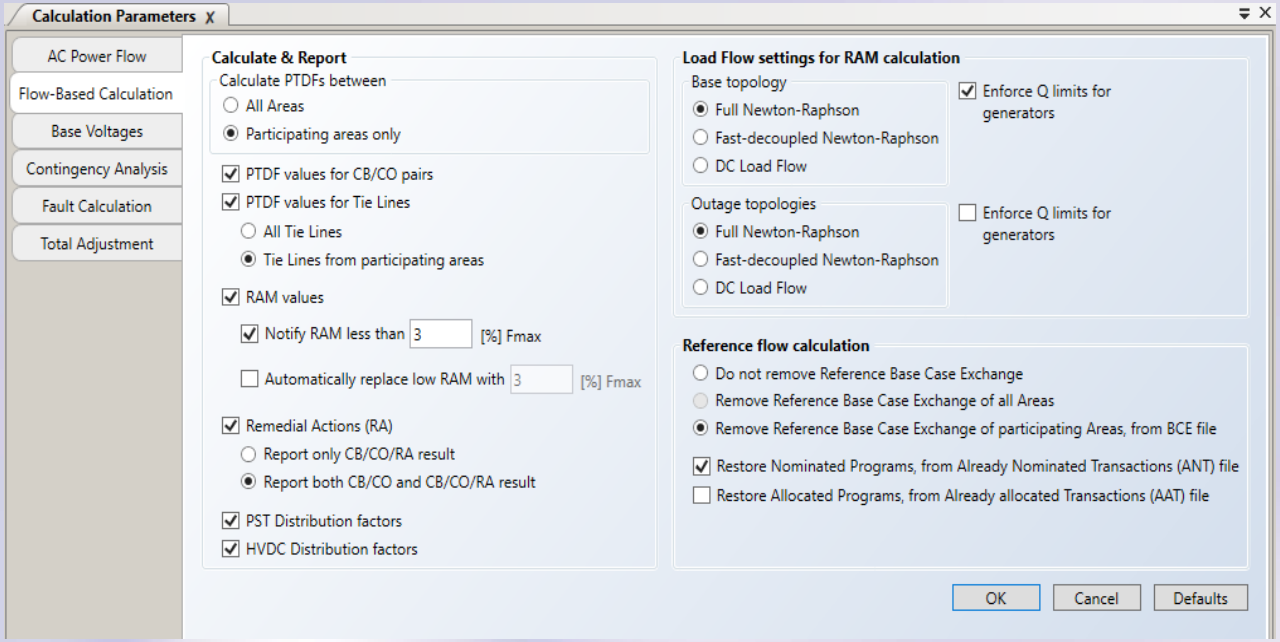


TNA: NTC calculation

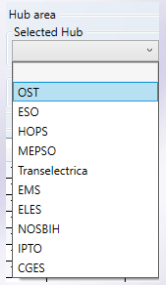


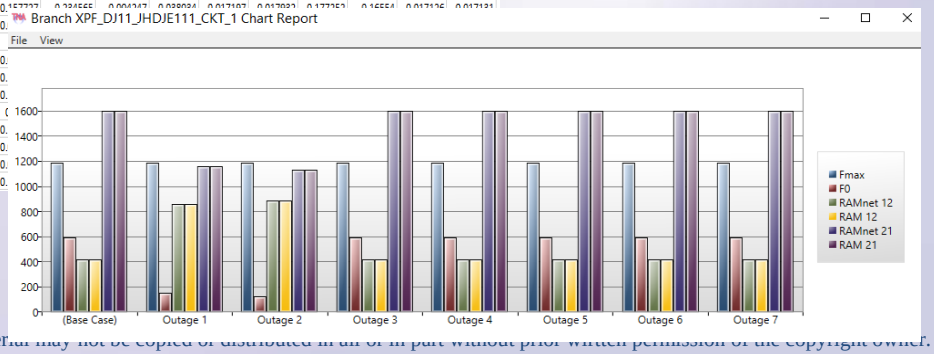


Flow based calculation (PTDF/RAM)

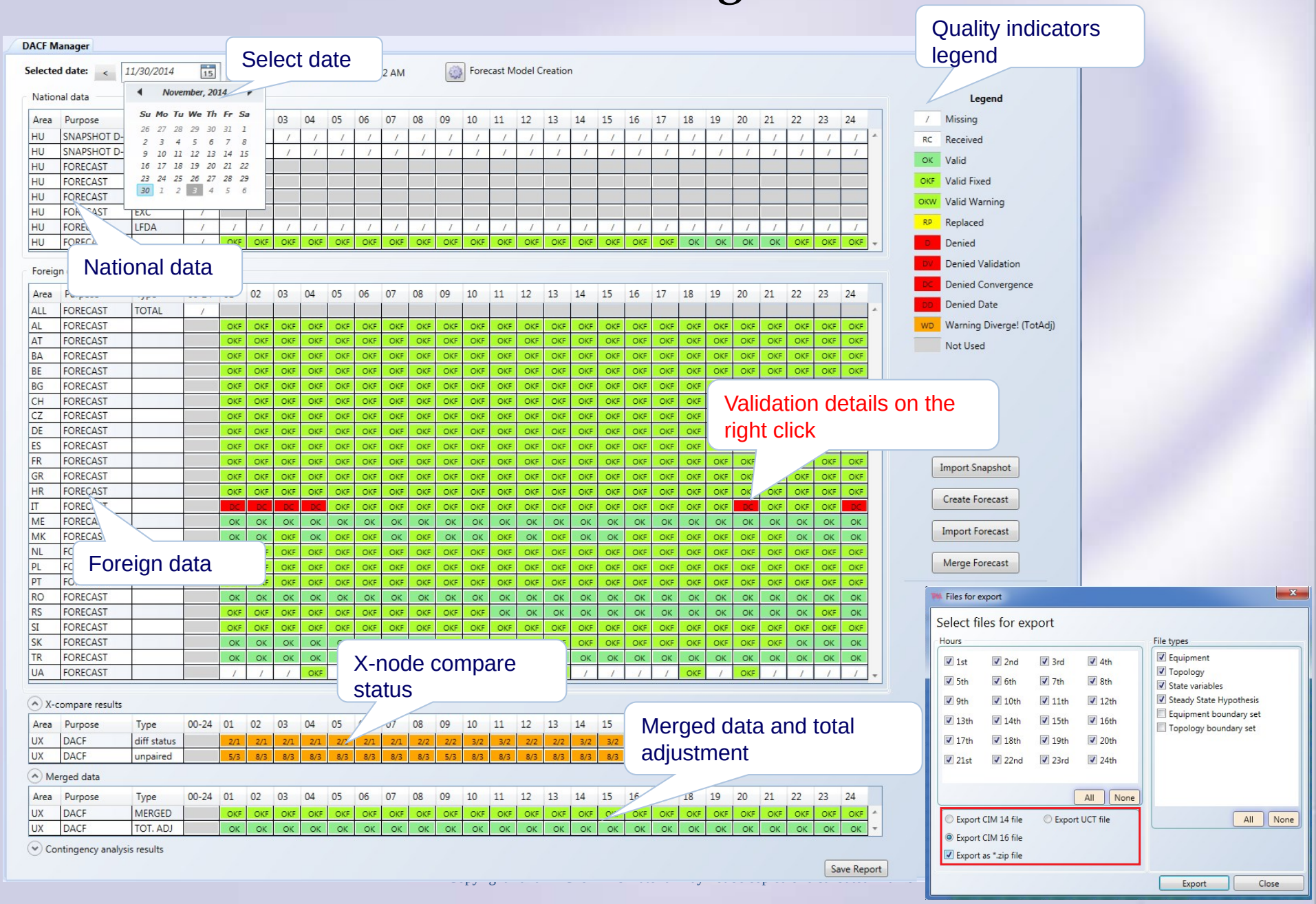


Critical branch	Critical outage	Cos Phi	FRM 12 [MW]	FRM 21 [MW]	FAV 12 [MW]	FAV 21 [MW]	Imax [A]	Snom [MVA]	U1 [kV]	U2 [kV]	Smax [MVA]	Fmax [MW]	Fref [MW]	Fnp [MW]	F0 [MW]	RAMnet 12 [MW]	RAMnet 21 [MW]	ANF [MW]	Fref' [MW]	AAF 12 [MW]	AAF 21 [MW]	RAM 12 [MW]	RAM 21 [MW]	
XER_SM11_JSMIT21_CKT_1	(Base Case)	0	119.7	119.7	59.9	59.9	1920	1330.2	400	400	1330.2	1197.2	-156.7	0	-156.7	1174.3	860.9	0	-156.7	0	0	1174.3	860.9	
		PDTF from	o	RTE	TTN	PSE	REN	SEPS	TEIAS	OST	APG	ESO	HOPS	MAVIR	MEPSO	Transelectr	EMS	ELES	WPS	NOSBIH	TERNA	IPTO	CGES	ELIA
		RTE		-0.000037	0.004812	0.000023	0.002188	0.158076	0.153497	-0.004943	0.157663	0.037094	-0.017173	0.161249	0.140554	0.217392	-0.012926	0.02086	0.000024	0.000759	0.160079	0.148367	-0.000047	-0.000042
		TTN	0.000037		0.004849	0.000061	0.002225	0.158113	0.153535	-0.004905	0.1577	0.037132	-0.017136	0.161286	0.140592	0.217429	-0.012889	0.020898	0.000062	0.000796	0.160116	0.148404	-0.00001	-0.000005
		PSE	-0.004812	-0.004849		-0.004788	-0.002624	0.153264	0.148685	-0.009755	0.152851	0.032282	-0.021985	0.156437	0.135742	0.21258	-0.017738	0.016049	-0.004788	-0.004053	0.155267	0.143555	-0.004859	-0.004854
		REN	-0.000023	-0.000061	0.004788		0.002164	0.158052	0.153474	-0.004966	0.157639	0.037071	-0.017197	0.161225	0.140531	0.217368	-0.01295	0.020837	0.000001	0.000735	0.160055	0.148344	-0.000071	-0.000066
		SEPS	-0.002188	-0.002225	0.002624	-0.002164		0.155888	0.15131	-0.007131	0.155475	0.034907	-0.019361	0.159061	0.138367	0.215204	-0.015114	0.018673	-0.002164	-0.001429	0.157891	0.146179	-0.002235	-0.00223
		TEIAS	-0.158076	-0.158113	-0.153264	-0.158052	-0.155888		-0.004579	-0.163019	-0.000413	-0.120982	-0.175249	0.003173	-0.017522	0.059316	-0.171002	-0.137215	-0.158052	-0.157317	0.002003	-0.009709	-0.158123	-0.158118
		OST	-0.153497	-0.153535	-0.148685	-0.153474	-0.15131	0.004579		-0.15844	0.004165	-0.116403	-0.17067	0.007751	-0.012943	0.063895	-0.166424	-0.132637	-0.153473	-0.152739	0.006582	-0.00513	-0.153545	-0.153539
		APG	0.004943	0.004905	0.009755	0.004966	0.007131	0.163019	0.15844		0.162605	0.042037	-0.01223	0.166192	0.145497	0.222335	-0.007983	0.025803	0.004967	0.005702	0.165022	0.15331	0.004896	0.004901
		ESO	-0.157663	-0.1577	-0.152851	-0.157639	-0.155475	0.000413	-0.004165	-0.162605		-0.120568	-0.174836	0.003586	-0.017108	0.059729	-0.170589	-0.136802	-0.157638	-0.156904	0.002416	-0.009296	-0.15771	-0.157705
		HOPS	-0.037094	-0.037132	-0.032282	-0.037071	-0.034907	0.120982	0.116403	-0.042037	0.120568		-0.054267	0.124154	0.10346	0.180298	-0.050021	-0.016234	-0.03707	-0.036336	0.122985	0.111273	-0.037142	-0.037136
		MAVIR	0.017173	0.017136	0.021985	0.017197	0.019361	0.175249	0.17067	0.01223	0.174836	0.054267		0.178422	0.157727	0.234655	0.004947	0.038034	0.017197	0.017932	0.177252	0.16554	0.017126	0.017131
		MEPSO	-0.161249	-0.161286	-0.156437	-0.161225	-0.159061	-0.003173	-0.007751	-0.166192	-0.003586	-0.124154	-0.178422		-0.157727	-0.234655	-0.004947	-0.038034	-0.017197	-0.017932	-0.177252	-0.16554	-0.017126	-0.017131
		Transelectrica	-0.140554	-0.140592	-0.135742	-0.140531	-0.138367	0.017522	0.012943	-0.145497	0.017108	-0.10346	-0.157727	0.020694										
		EMS	-0.217392	-0.217429	-0.21258	-0.217368	-0.215204	-0.059316	-0.063895	-0.222335	-0.059729	-0.180298	-0.234565	-0.056143										
		ELES	0.012926	0.012889	0.017738	0.01295	0.015114	0.171002	0.166424	0.007983	0.170589	0.050021	-0.004247	0.174175										
		WPS	-0.02086	-0.020898	-0.016049	-0.020837	-0.018673	0.137215	0.132637	-0.025803	0.136802	0.016234	-0.038034	0.140388										
		NOSBIH	-0.000024	-0.000062	0.004788	-0.000001	0.002164	0.158052	0.153473	-0.004967	0.157638	0.03707	-0.017197	0.161224										
		TERNA	-0.000759	-0.000796	0.004053	-0.000735	0.001429	0.157317	0.152739	-0.005702	0.156904	0.036336	-0.017932	0.16049										
		IPTO	-0.160079	-0.160116	-0.155267	-0.160055	-0.157891	-0.002003	-0.006582	-0.165022	-0.002416	-0.122985	-0.177252	0.00117										
		CGES	-0.148367	-0.148404	-0.143555	-0.148344	-0.146179	0.009709	0.00513	-0.15331	0.009296	-0.111273	-0.16554	0.012882										
		ELIA	0.000047	0.00001	0.004859	0.000071	0.002235	0.158123	0.153545	-0.004896	0.15771	0.037142	-0.017126	0.161296										

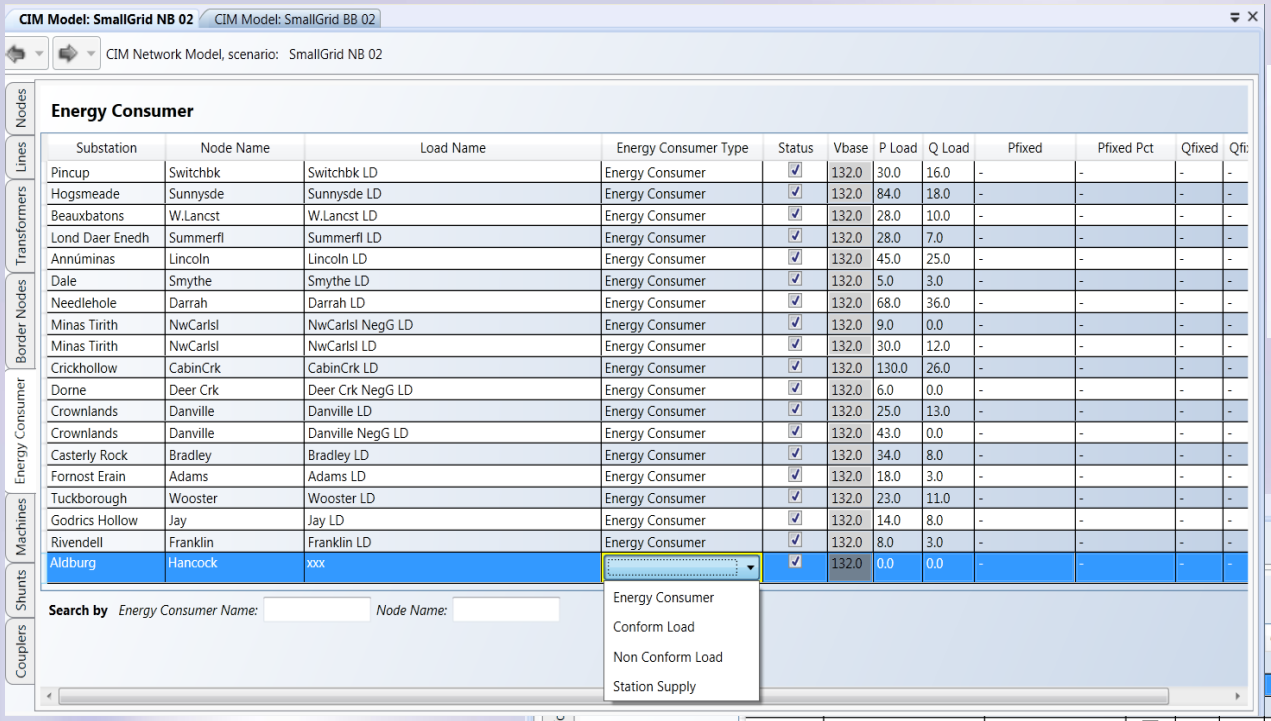


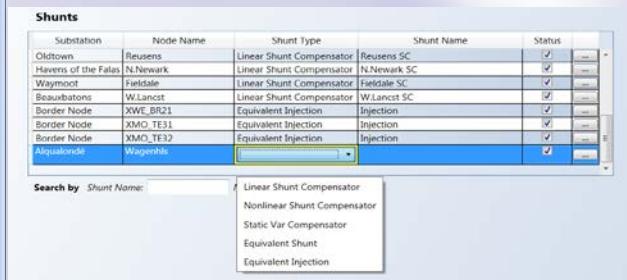


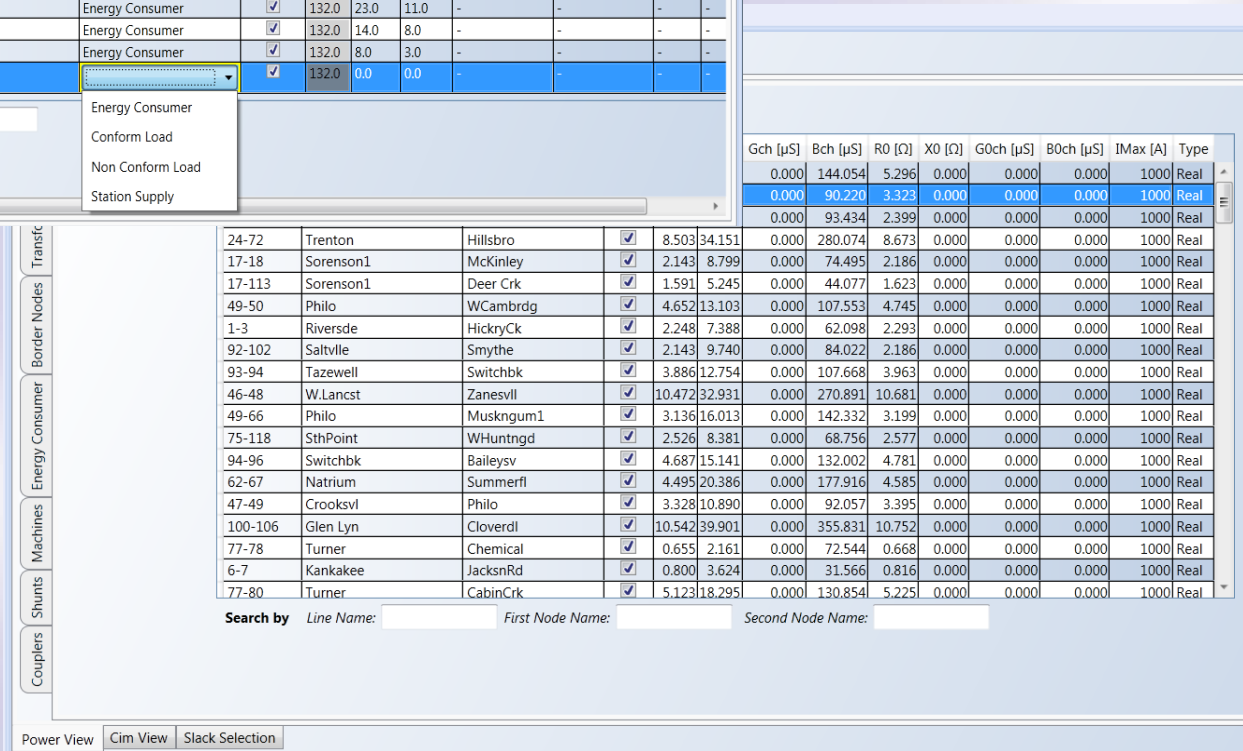
TNA: DACF/IDCF/D2CF Manager



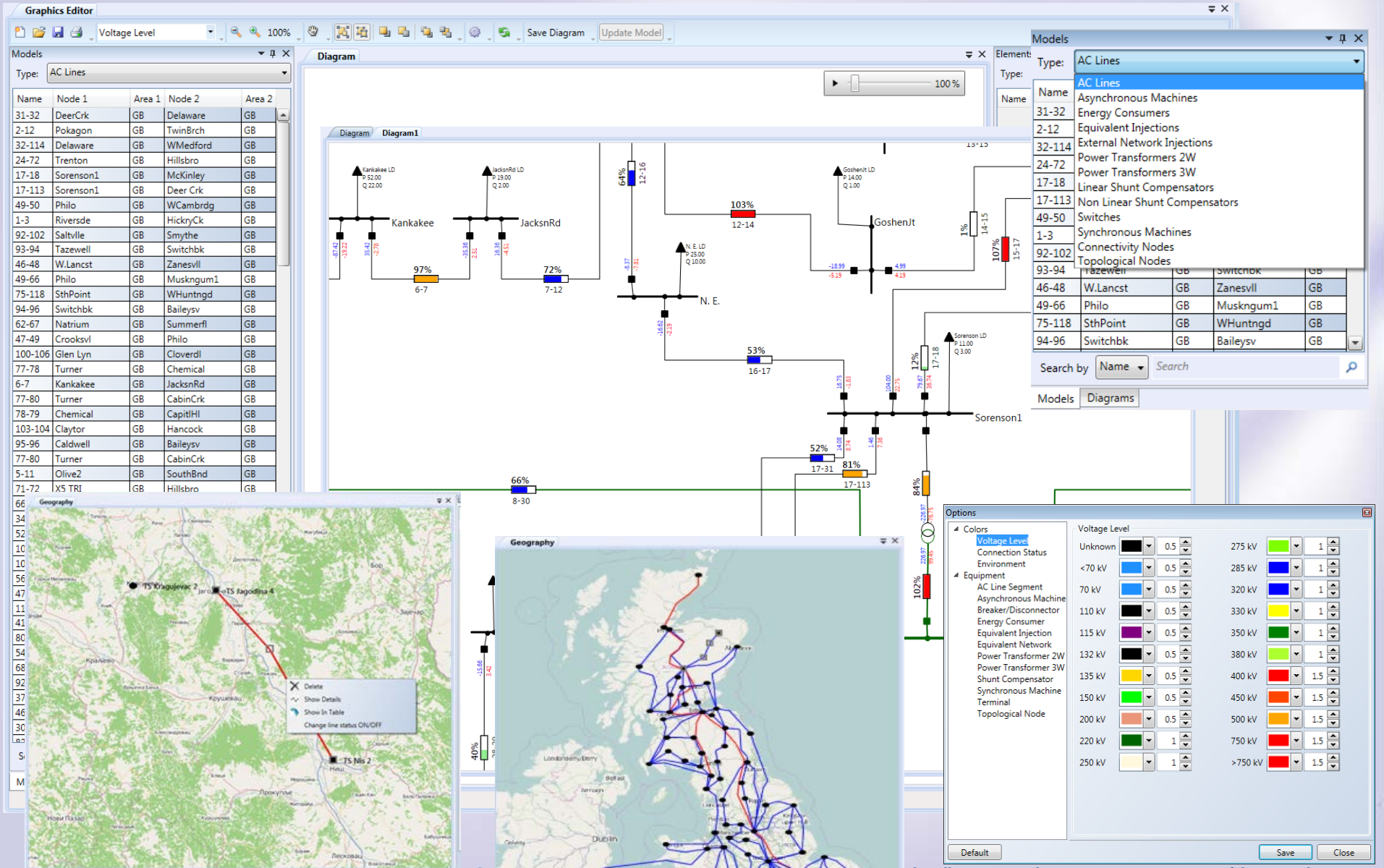
Model builder: UCT/CGMES







TNA 2.3 Graphical builder



TNA 2.3 Conversion tools

Formats: UCTE - PSSE RAW – CGMES (CIM)