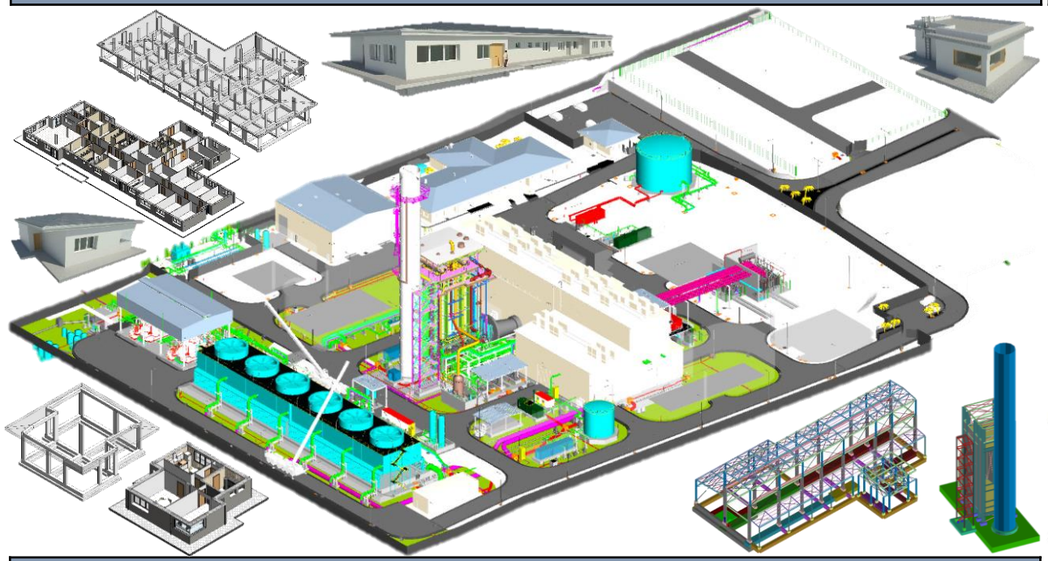
FEATURE OF TECHNICAL SERVICE

Subject	Detailed architectural and structural design of civil works with BIM return of the Thermoelectric Power Station in Armenia Yerevan 250MW Combined Cycle Power Plant (YCCPP2) - Yerevan Capital City			
Carried out by	SGAI S.r.l. di E. Forlani & C.			
Client	RENCO S.p.a.			
Service length	2017 I phase		2018 – on going II phase	
Value of works	I phase	€ 1’800’000,00	II phase	€ 4’700’000,00
Categories value	E.02	€ 1’800’000,00	S.05	€ 1’400’000,00
	S.06	€ 700’000,00		

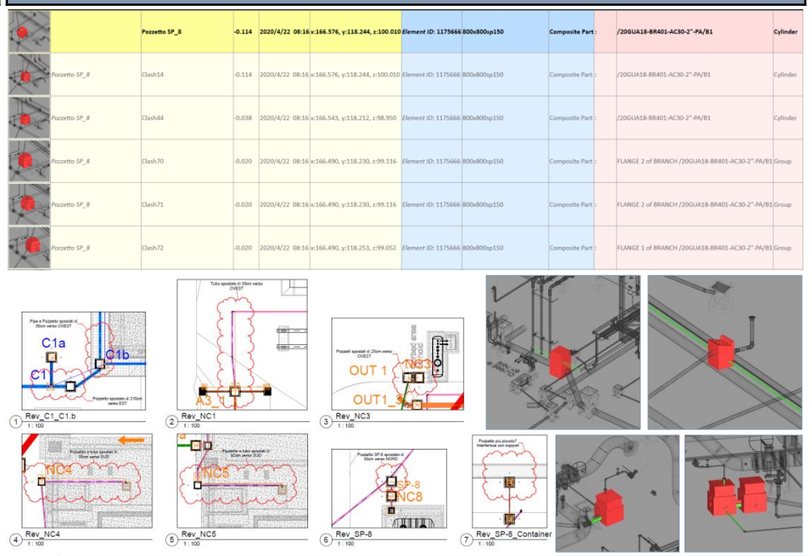
THERMOELECTRIC POWER STATION - Design according to BIM methodology

As part of the energy production development program, organized by the Armenian Ministry of Energy (MOE), the construction of a new combined cycle (gas and steam) thermoelectric plant is planned in the suburbs of the city of Yerevan, adjacent to another existing plant.
The project involves the construction of numerous buildings for housing machinery and equipment, as well as service structures, technological systems and access roads to the various sectors of the plant. **The entire project was managed and developed by applying the BIM management process, firstly creating the 3D model of the entire plant, containing all the information necessary for its construction, operation and maintenance**. In this context, **the positions of BIM Manager and BIM coordinator were prepared**, **carrying out the management, coordination, control and verification of interference** (**Clash Detection**) and information required by the **LOD** (**Level Of Detail**). In particular, the detailed structural and architectural design, according to BIM methodology, of the following buildings was carried out: Operation Building, Main Security Building and Electrical Building. In addition, special foundations for gas and steam turbines have been designed, characterized by strong vibrations, as well as the foundations of numerous other buildings and complementary works such as: Turbine Building, Warehouse Building, Cooling Tower, HRSG heat recovery unit, chimney (over 60m high), cisterns, pipe racks, retaining walls, etc.
The design of the internal access roads to the plant and the storage areas was also carried out, as well as the hydraulic regulation of the entire area of the plant including the rainwater disposal grid and related treatment network (drains, manholes, pipes, etc.).

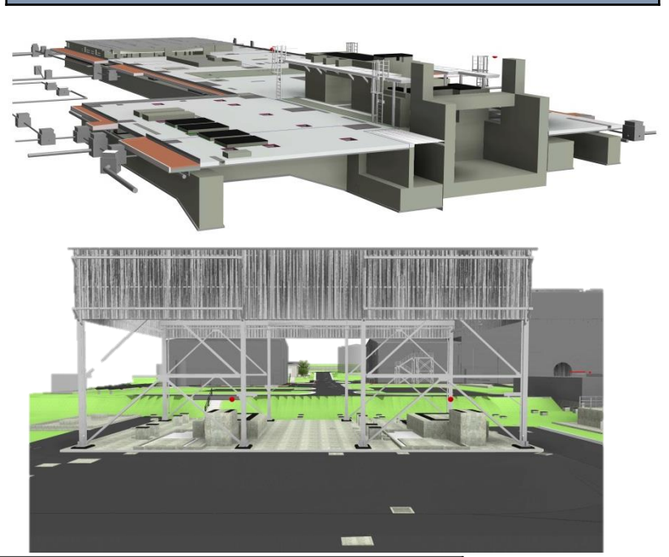
3D-BIM Model of the plant



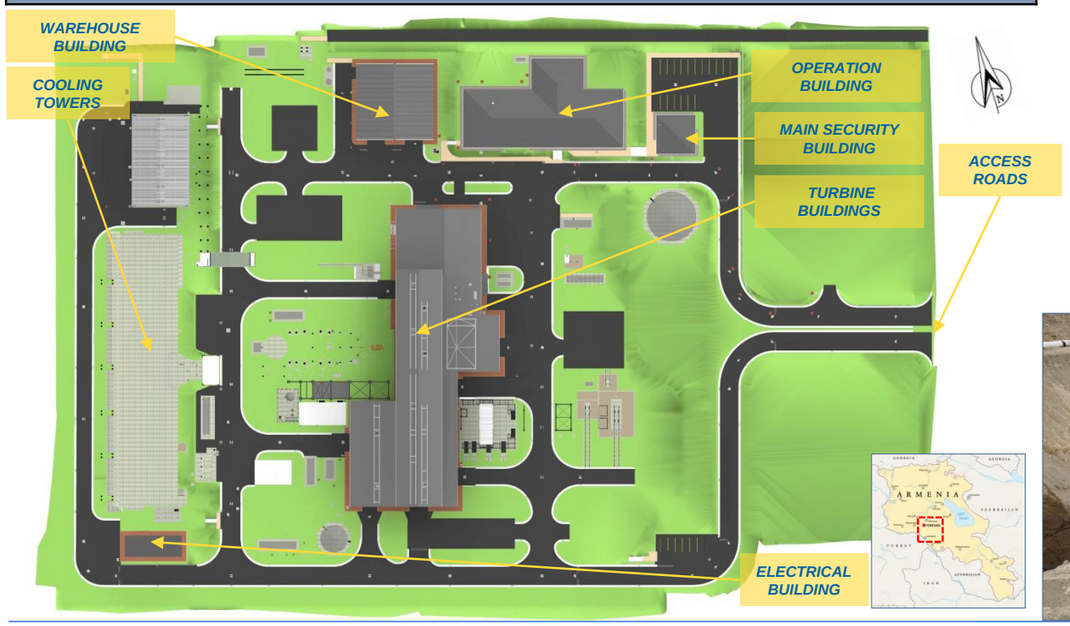
Clash Detection



Modeling of the hydraulic grid and buildings



Plan view of the BIM Model



Progress of the construction processing

CIVIL AND INDUSTRIAL STRUCTURES

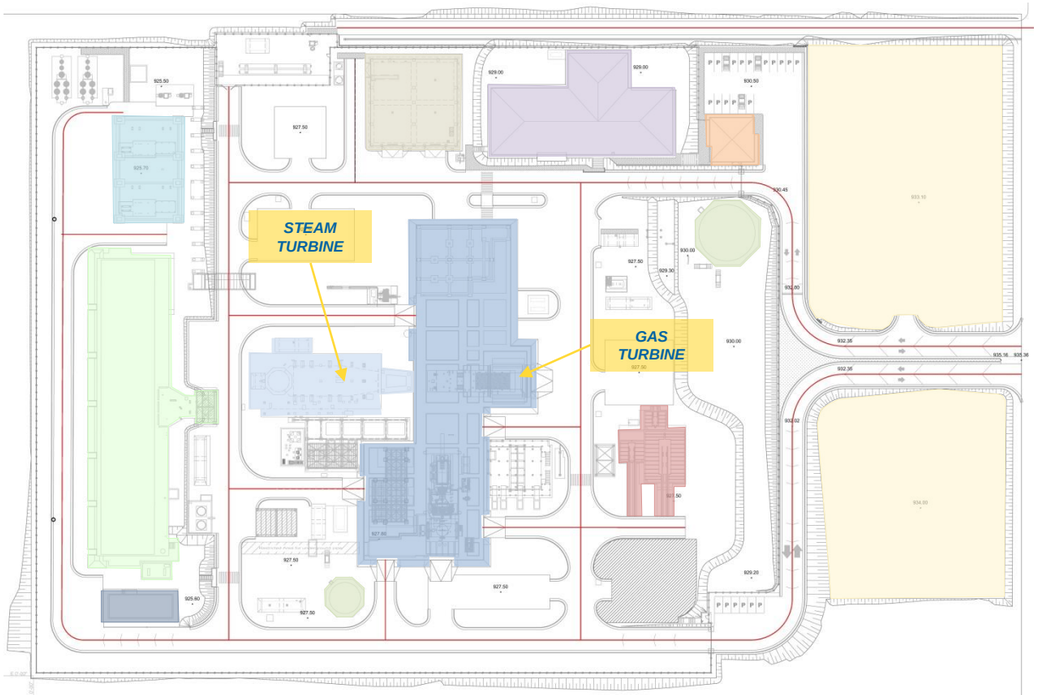
DYNAMIC ANALISES - Computational aspects, simulation and checks

The foundations of the thermoelectric turbines were analyzed in detail, conducting dynamic and seismic analyzes with finite element numerical models (2D and 3D), solved with the ***PLAXIS***, ***SAP2000*** and ***PROSAP*** calculation code (for validation and cross-checking of the results). The modeling, combined with an accurate geological and geotechnical investigation campaign, allowed the accurate assessment of the soil structure interaction, allowing to exclude amplifications due to resonance phenomena. In this way, it was possible to **reconstruct the stress-strain state of the subsoil during the operation of the vibrating machines**, thus obtaining an estimate of the bearing capacity and settlement of the subsoil subjected to cyclical actions.

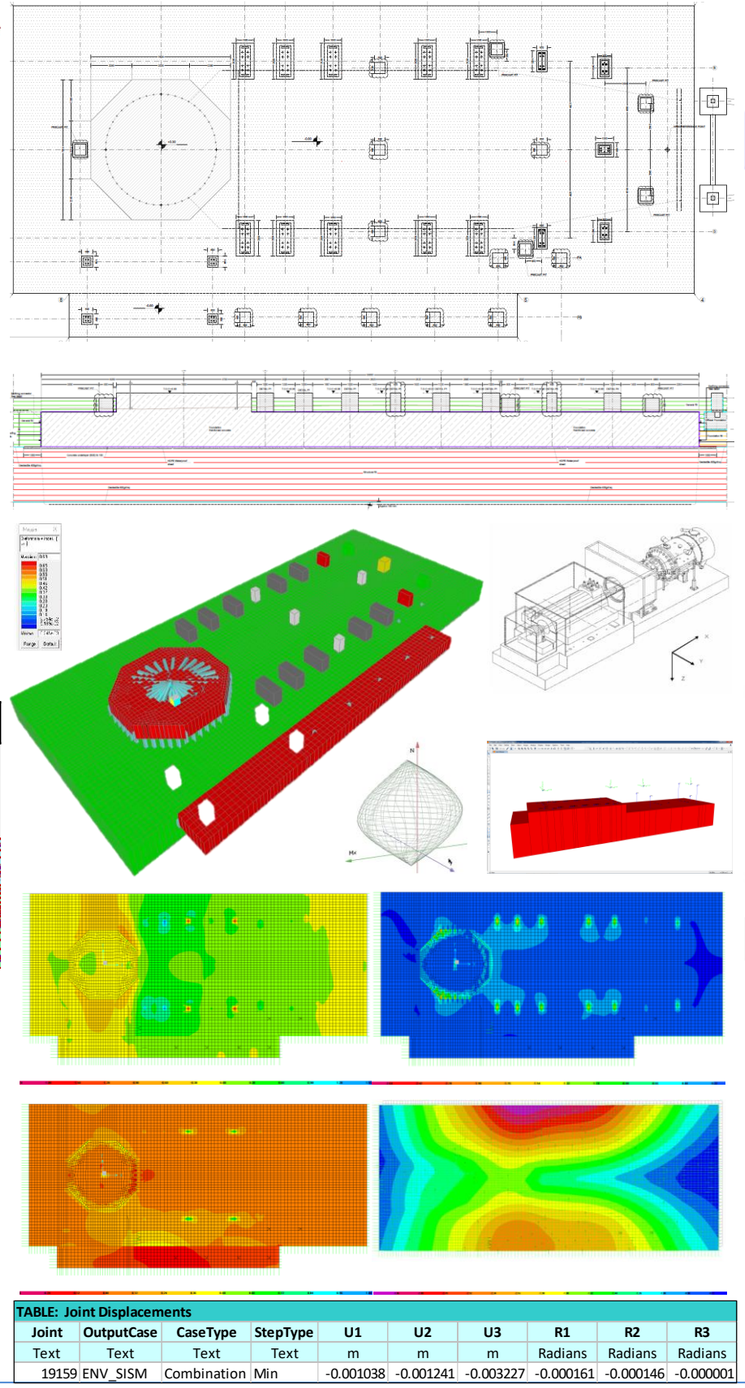
THERMOELECTRIC POWER STATION – Specialist Design: issues and their resolution

The project involves the design and construction, according to the BIM methodology, of numerous buildings for housing machinery and equipment, as well as service structures, technological systems and access roads to the various sectors of the plant. In support of the design, an **accurate geological, geotechnical and hydrogeological campaign was carried out aimed at the lithostratigraphic characterization of the soils on site, the verification of the bearing capacity and the susceptibility to liquefaction**. The greatest design difficulties were encountered in sizing and checking the foundations of the vibrating machines of the Turbine Building. Due to their complexity, the generation turbines require special foundations with reduced settlement and great stability against the stresses caused by cyclical actions, connected to the earthquake and vibrations during the operation of the machinery, in order to function properly.

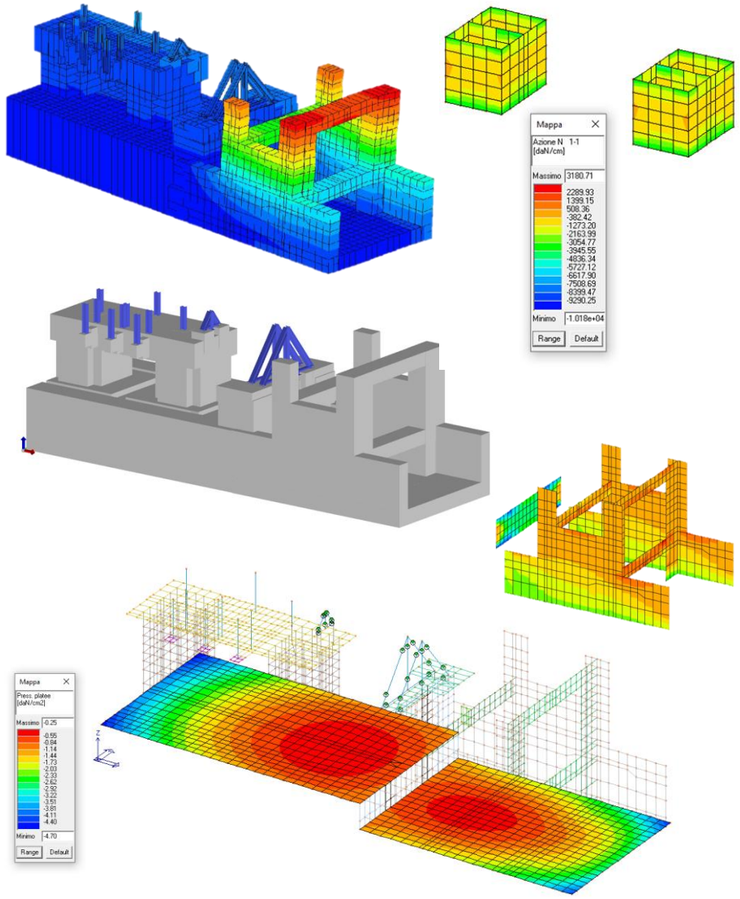
Design plan of the plant layout



GAS TURBINE - SAP2000 Model and checks



STEAM TURBINE – PROSAP Model and checks



SOIL STRUCTURE INTERACTION – PLAXIS Model and checks

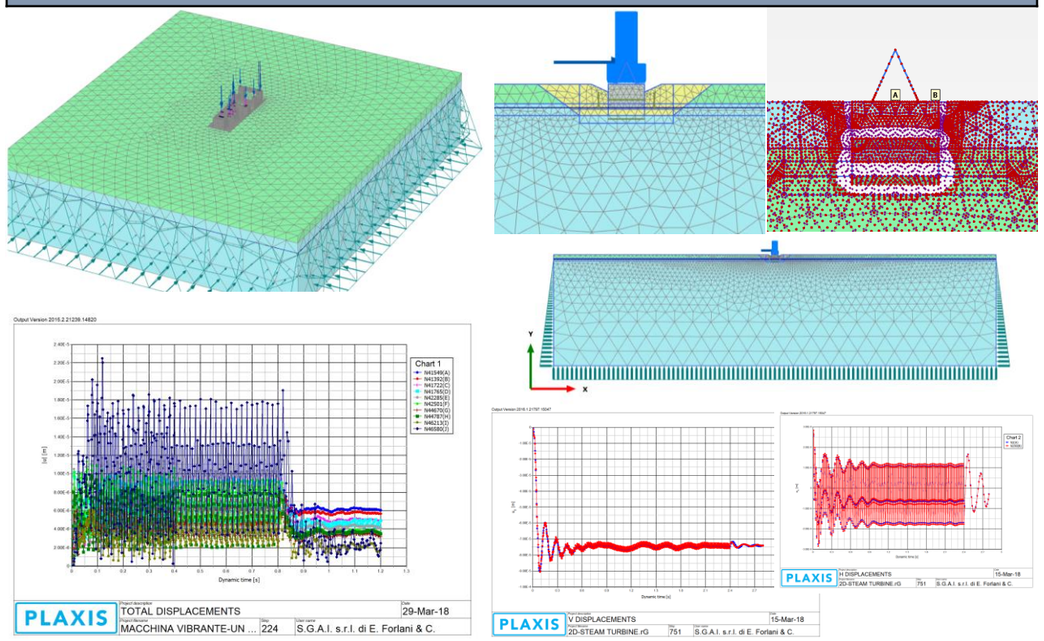
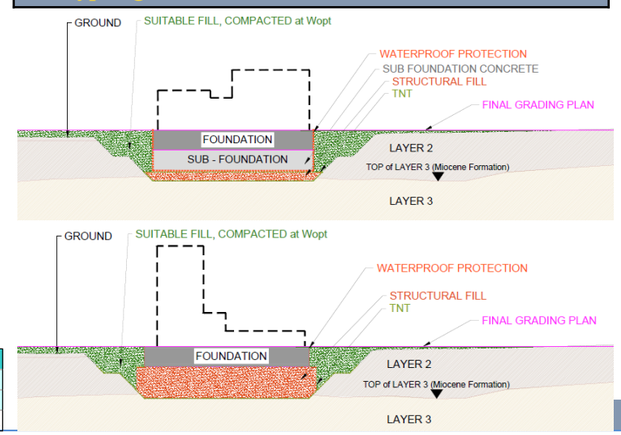


TABLE: Joint Displacements

Joint	OutputCase	CaseType	StepType	U1	U2	U3	R1	R2	R3
Text	Text	Text	Text	m	m	m	Radians	Radians	Radians
19159	ENV_SISM	Combination	Min	-0.001038	-0.001241	-0.003227	-0.000161	-0.000146	-0.000001

Typologic scheme of vibrant fondation structures



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