AVEVAWORLD
PARIS

Petrobras – Connecting design stages through the 3D Model – from Basic to Execution with AVEVA™ E3D Design

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Data: 15/10/2024

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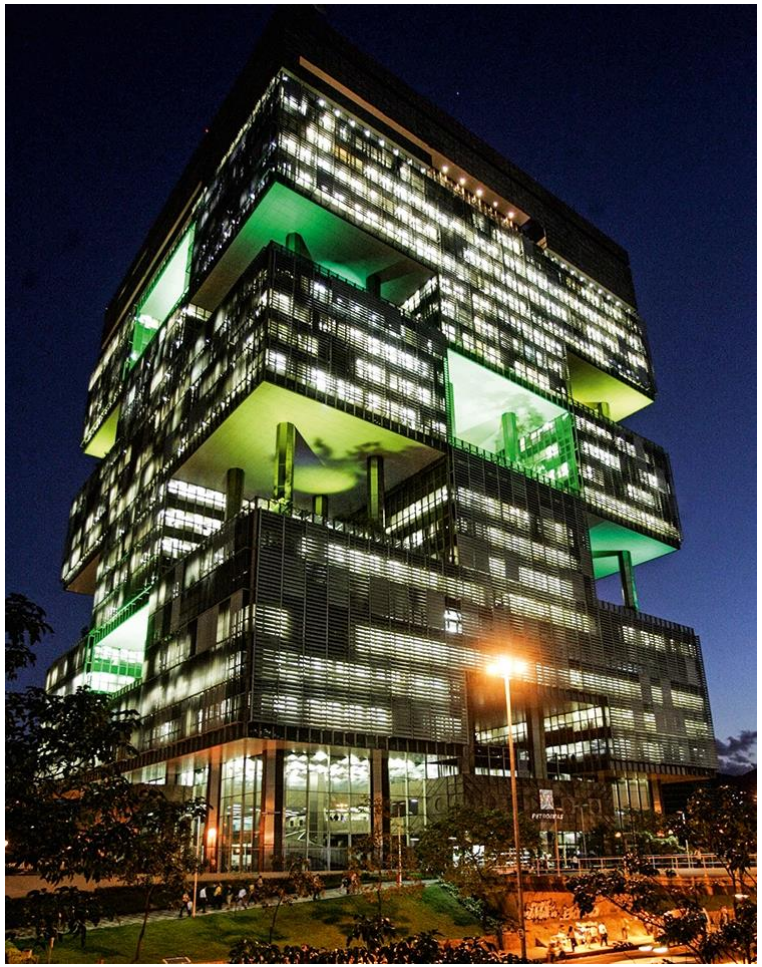
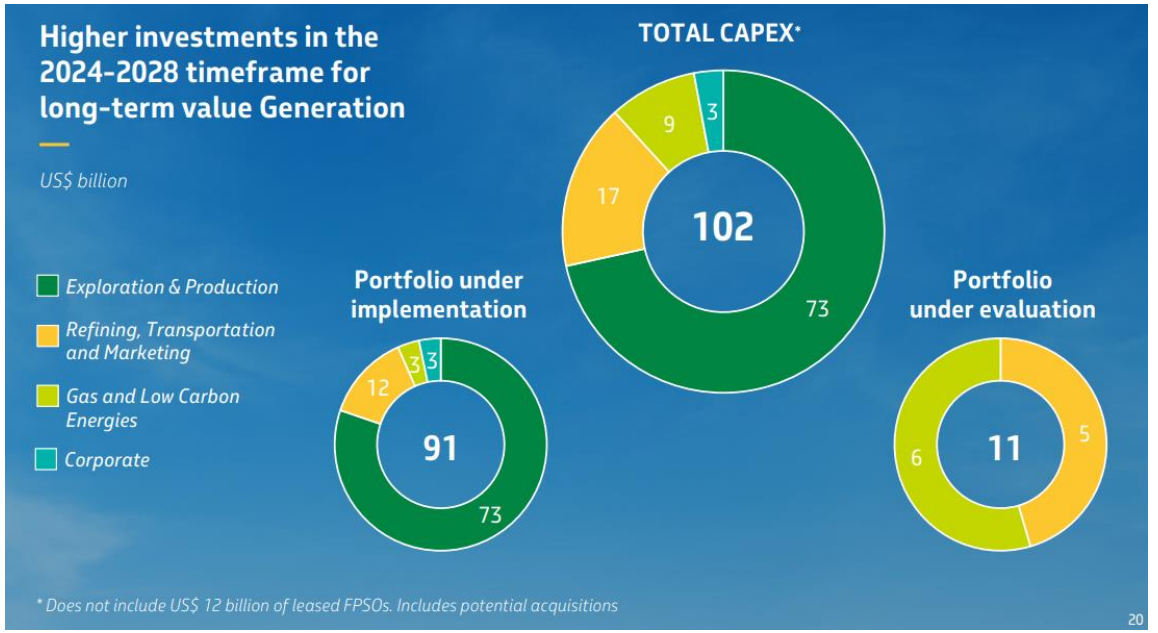


*2Q24 Results

Largest oil and gas producer in Brazil

HD:

Rio de Janeiro, Brazil



Year of establishment
1953

Annual Revenue:
US$
99.89bi

Daily Production:
2.78
mboed

Daily Refining :
1,744
bpd

Employees :
40,400

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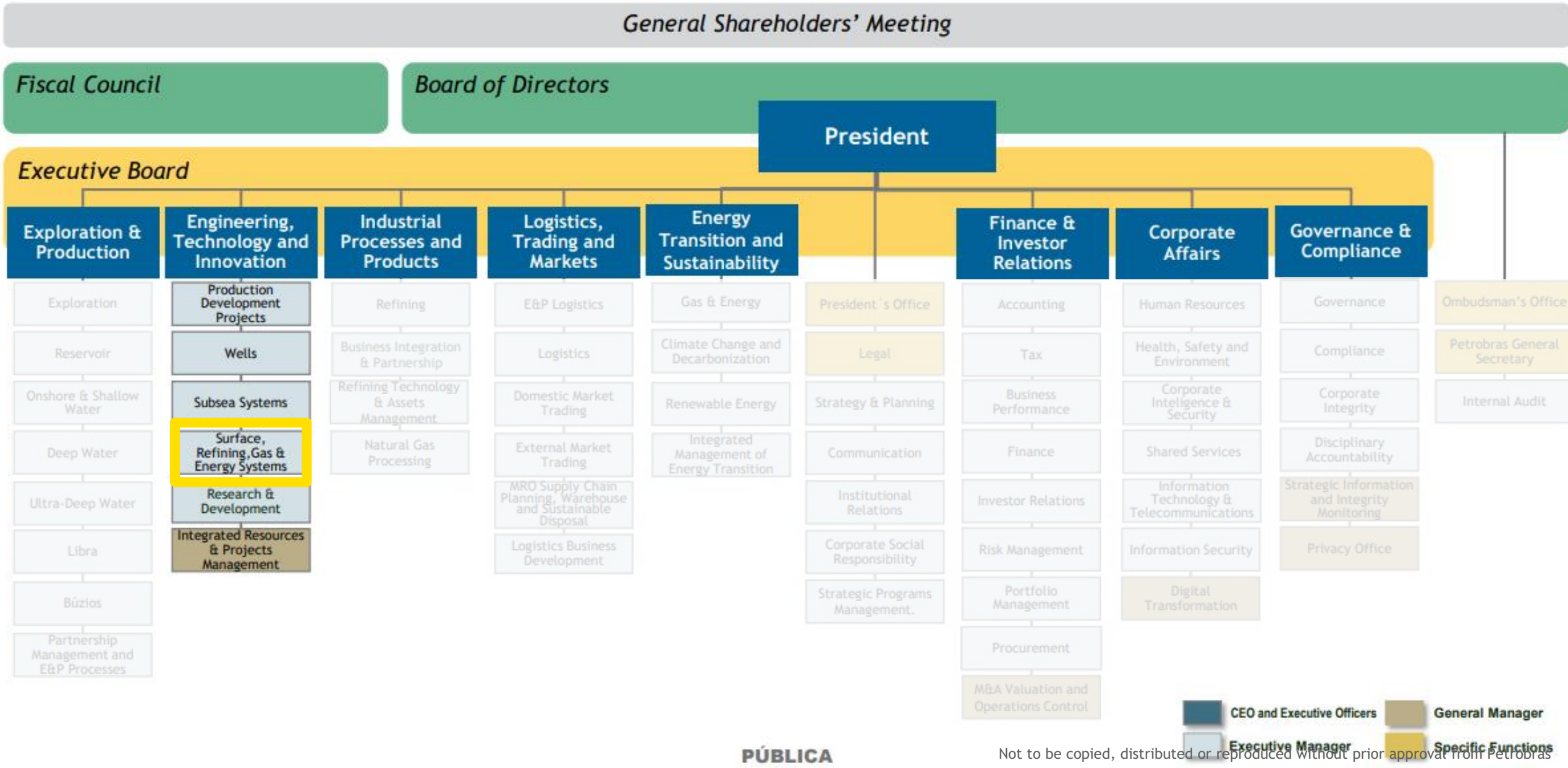
Organization Chart



PÚBLICA

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Investing in the expansion and upgrading of the industrial complex with a focus on high-value, low carbon products

		MAIN PROJECTS
Increase in Processing Capacity	225 kbpd	• *RNEST: Revamp Train 1 and implementation of Train 2* • *Revamps of current facilities*
Increase in S-10 diesel production capacity	> 290 kbpd***	• *New units HDT/HCC GASLUB*** • *REPLAN new HDT* • *Implementation of RNEST Train 2* • *Revamps of current facilities*
BioRefining*	34 kbpd	• *Dedicated plant in RPBC (SAF / Diesel R100)*** • *Dedicated plant GASLUB***
Lubricants Group II	12 kbpd	• *New unit HIDW GASLUB***
Petrochemicals and Fertilizers		• *Projects under study*

** 100% Renewable (Diesel R100) | ** Projects 2028+ | *** 80% new capacity / 20% revamps*

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Challenge

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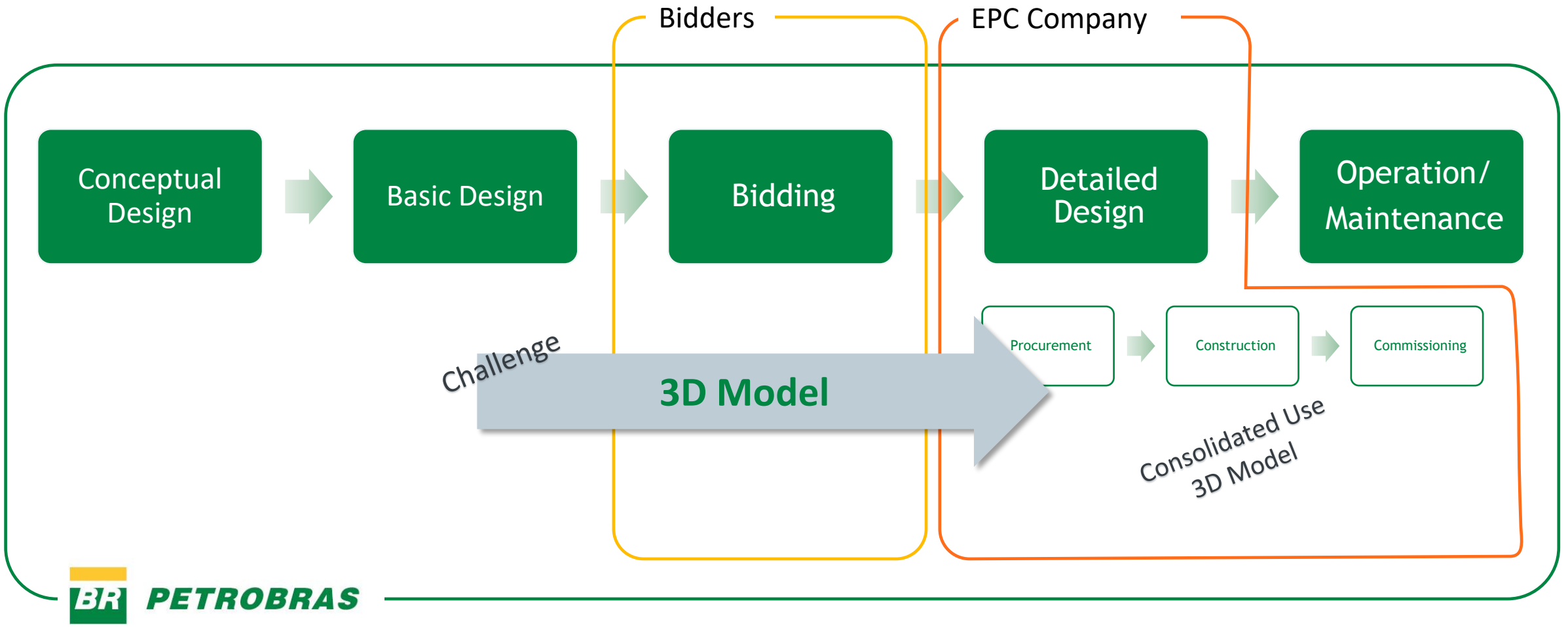
Context



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In the Basic Design Phase

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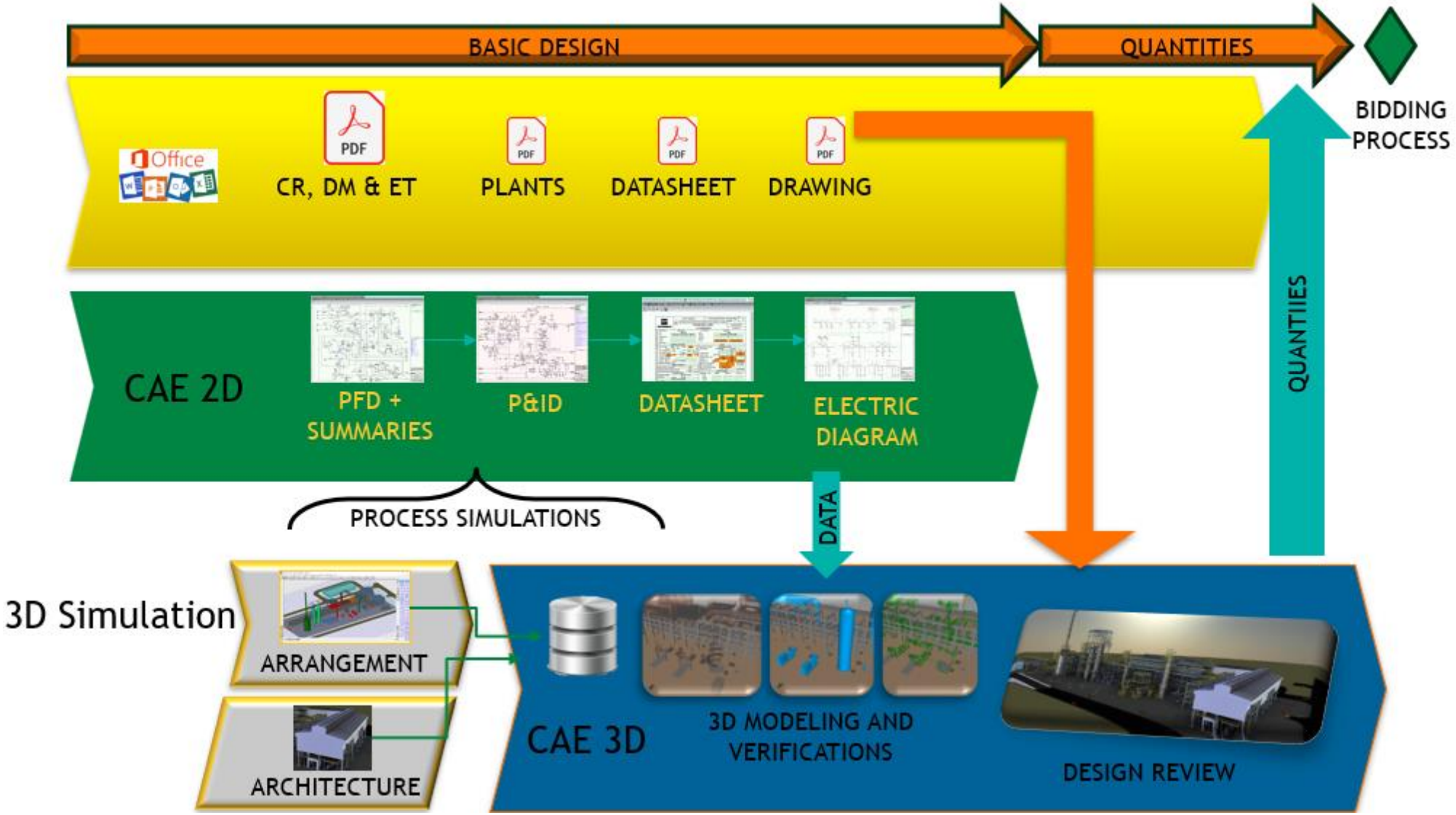
Overview



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Using the 3D Model - Challenges:

- Respect the project maturity level - Basic vs Detailed Design
- Most projects are BrownField
  - Even for new units, there are always interconnections with existing areas
- State of existing documentation: scanned vs 2D vs 3D (PDMS, E3D)
- Multiple scopes: demolition, expansion, adaptations

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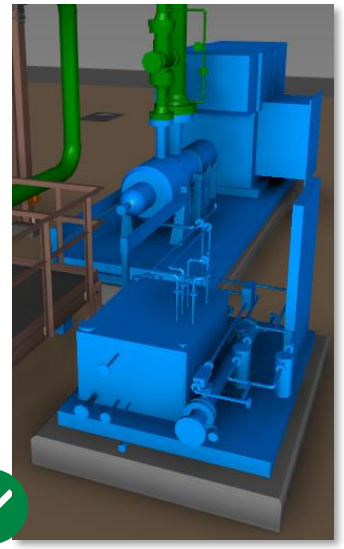
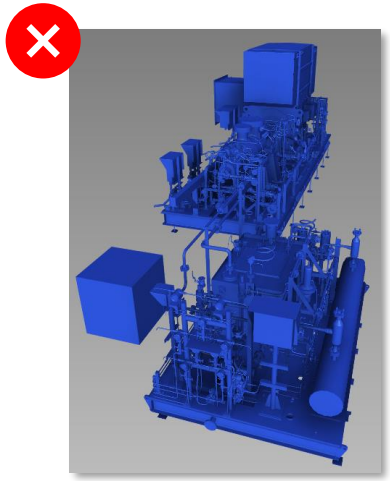
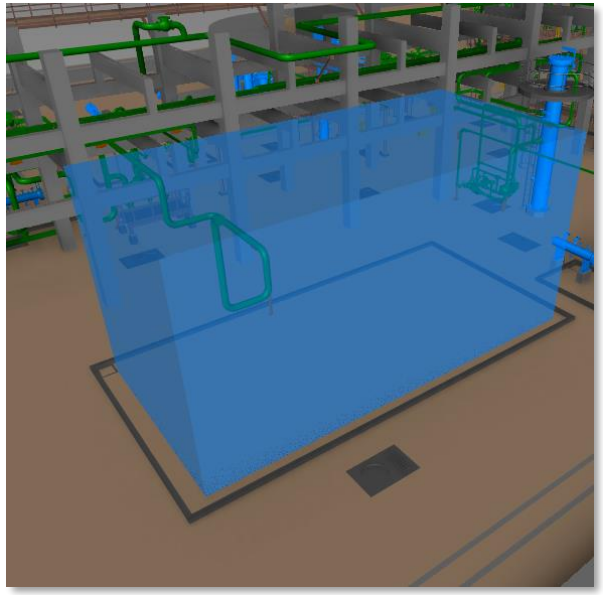
Maturity level - Basic vs Detailed Design

In basic design: there are no vendor drawings, there is no detailed package design







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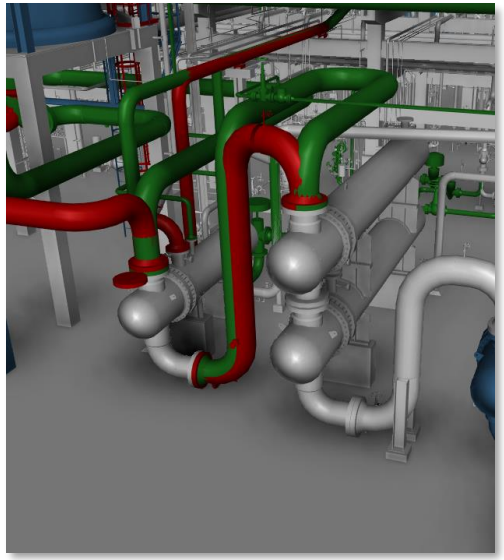
Brownfield Projects

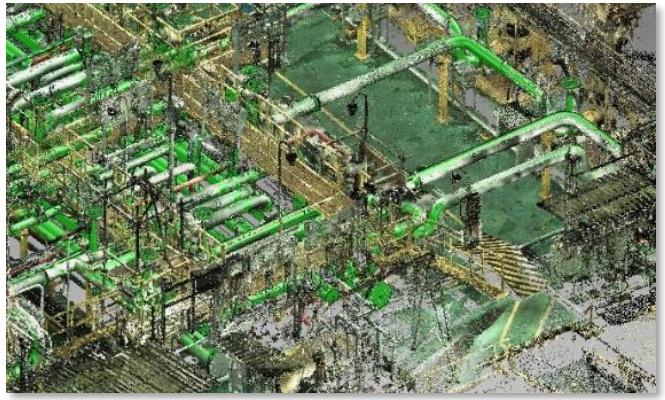
With existing 3D Model:

- Project developed in AVEVA E3D, overlaid on the existing model



Without existing 3D Model / Incomplete 3D Model:

- Project developed in AVEVA E3D, overlaid on point cloud and existing model (if available)
  - Acquisition (Scanner), processing and conversion of point cloud to E3D (AVEVA Point Cloud Manager) - contracted company



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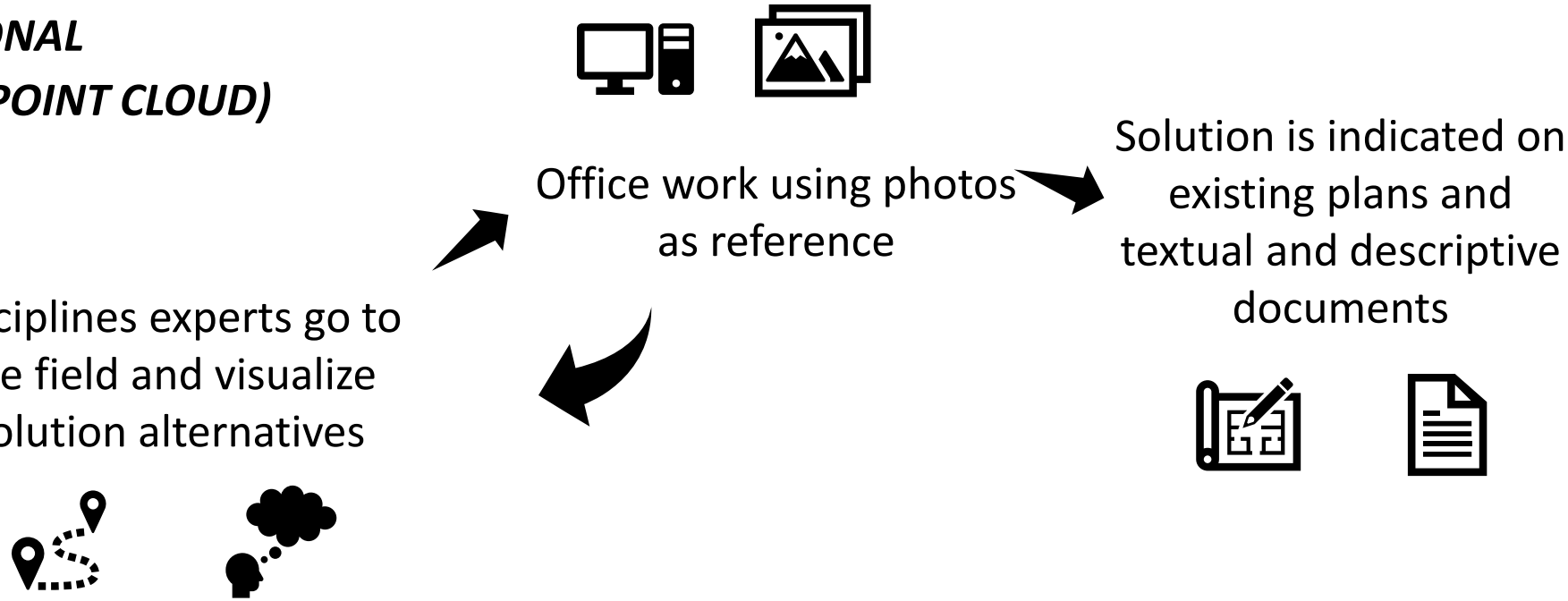
Work Process (Brownfield)

TRADITIONAL
(WITHOUT USING POINT CLOUD)



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Work Process (Brownfield)

TRADITIONAL

+ POINT CLOUDS

Office work with

Office work using photos

as reference

3D enviroment

+ 360 Photos

+ Point Cloud

Disciplines experts go to the field and visualize solution alternatives

Laser Scaning

Solution is indicated in 3D Model

Solution is indicated on existing plans and t

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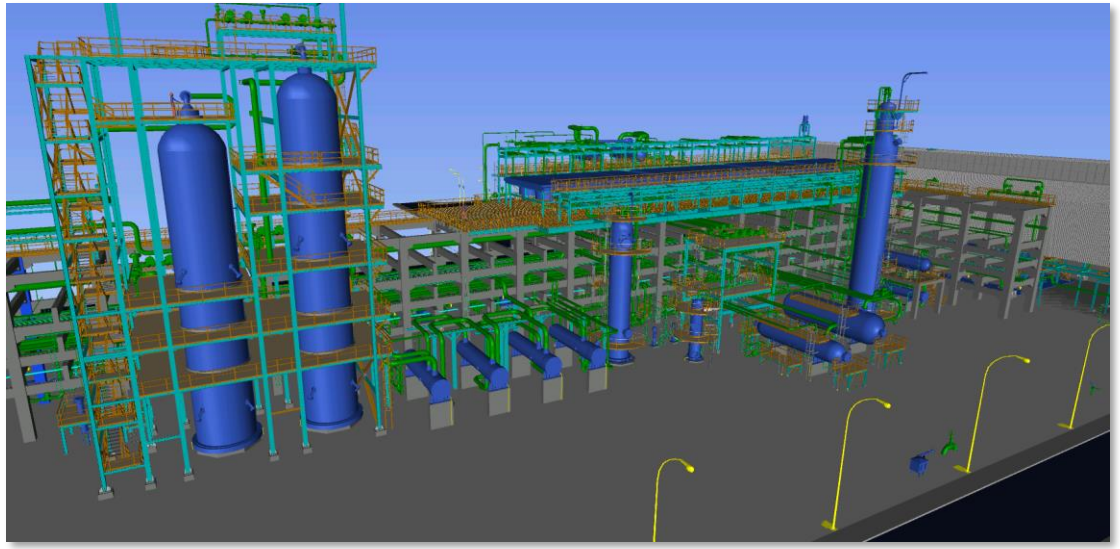
Benefits from developing the project in 3D

- Consistency between disciplines



- Interference checking

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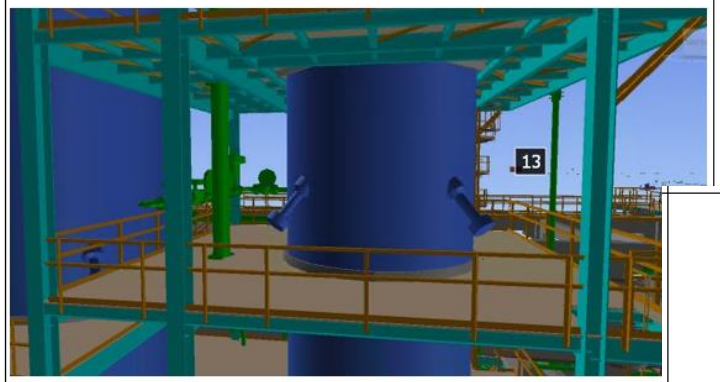
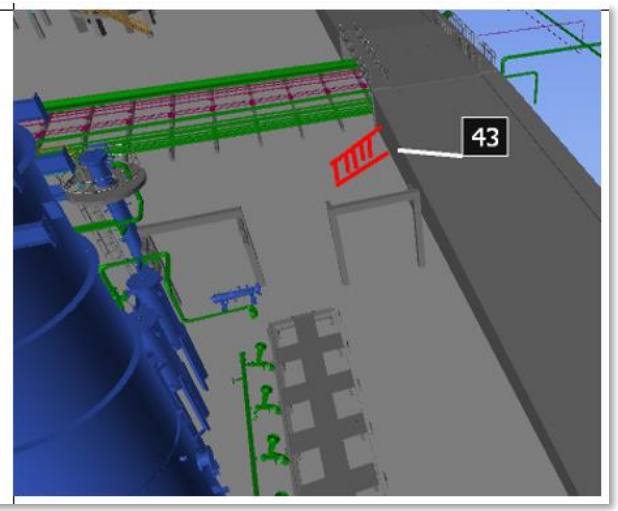
Benefits from developing the project in 3D

- Design Review with 3D Model
- Early multidisciplinary analysis - comments on ergonomics, operation, maintenance, safety

Incorporate the minimum distance between the platform and the disposal nozzle for connecting the disposal device and the hose, for the upper beds of the reactors. Include the location of the hatch opening for the hose passage.



Include a stairway to the street to facilitate an escape route.



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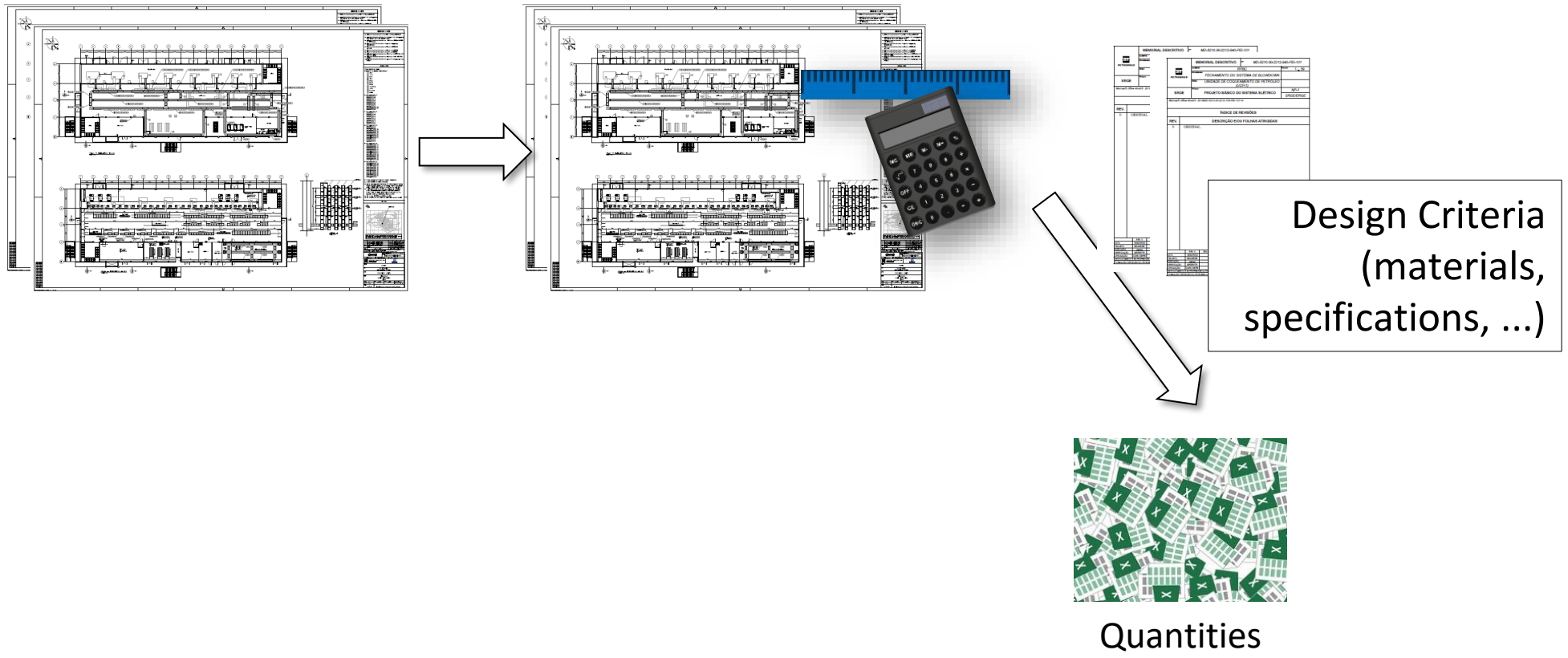
Benefits from developing the project in 3D

- Automatic extraction of quantities for cost estimation



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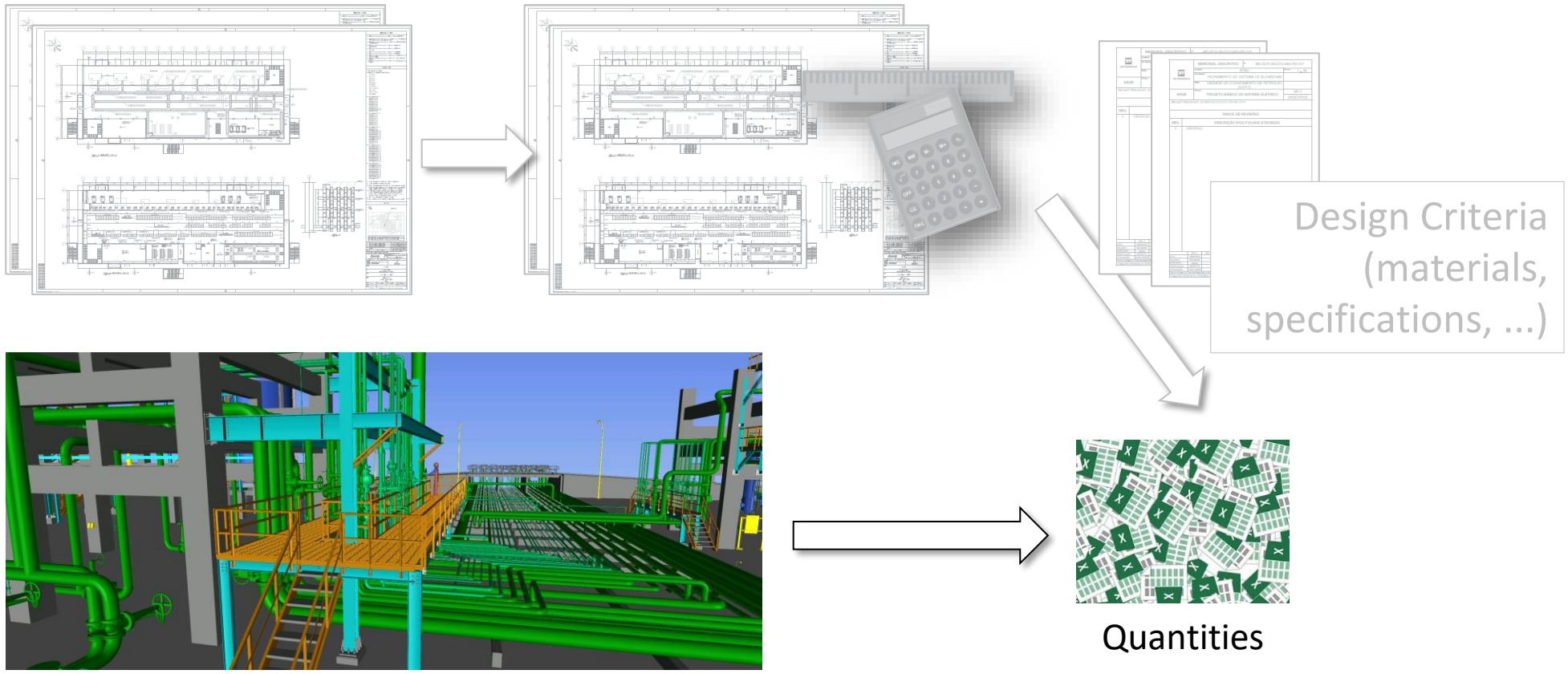
Benefits from developing the project in 3D

- Automatic extraction of quantities for cost estimation
- (~ 80% hh reduction)



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In the Basic Design Phase

Team Engagement

- Opportunities and Developments in the Internal Startup
- Examples:
  - Configuration of customized reports to meet the cost estimation system (piping, steel structure)
  - Cable tray and electrical/instrumentation cable catalog focused on the estimation system
  - Development of templates and reference projects (substations)
  - Modeling and calculation of excavation volumes

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Modeling and calculation of excavation volumes

USE CASES - AUTOMATION

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Excavations: foundations, boxes and buried pipelines

- Construction works generate excavations
- There are earthworks involved
- Transportation of volumes
- Disposal and purchase of backfill materials

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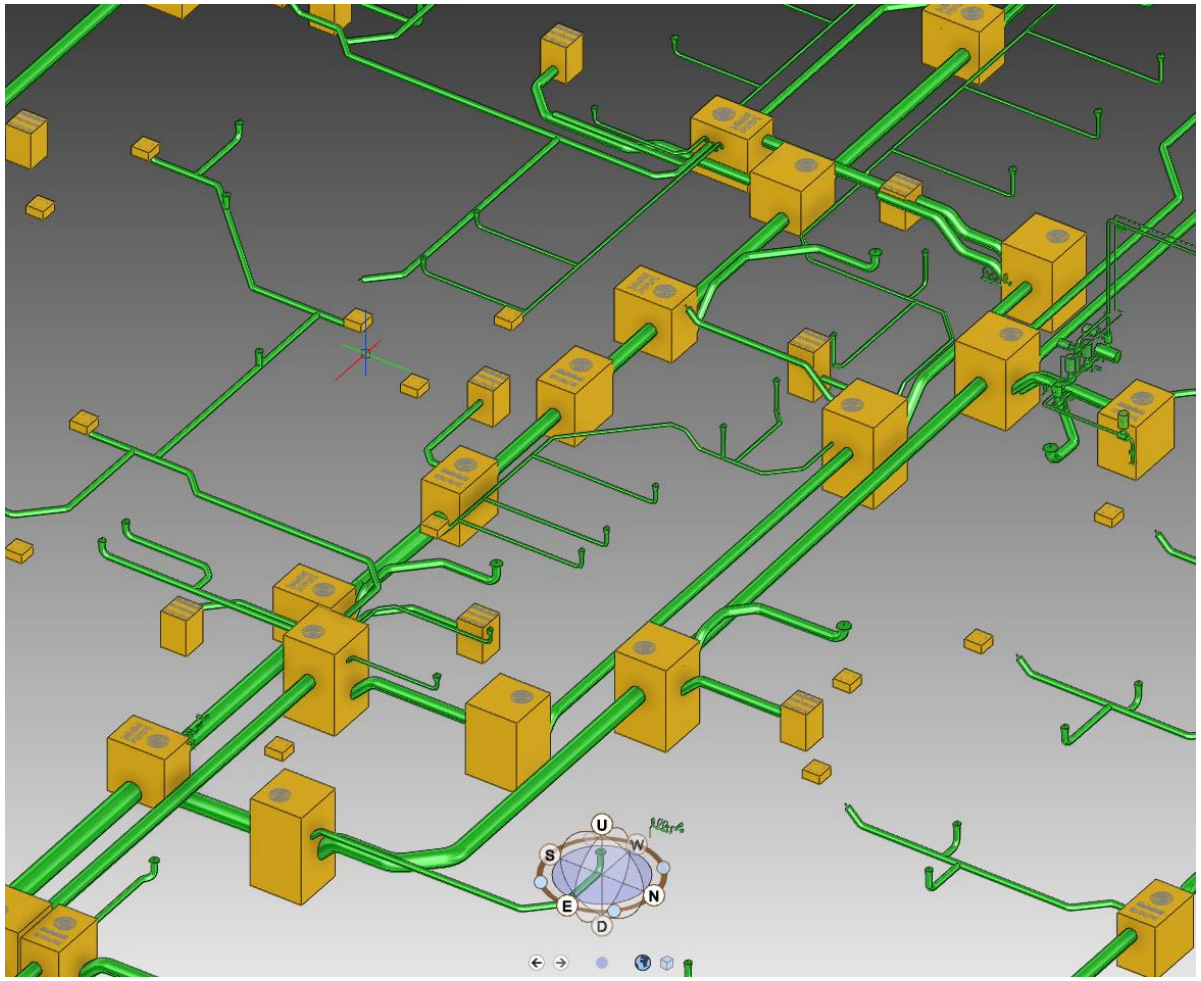
Example - Drainage System



Challenge:

- Large number of elements
- Interlacing and interferences
- Spreadsheet without visuals
- Simplified formulas

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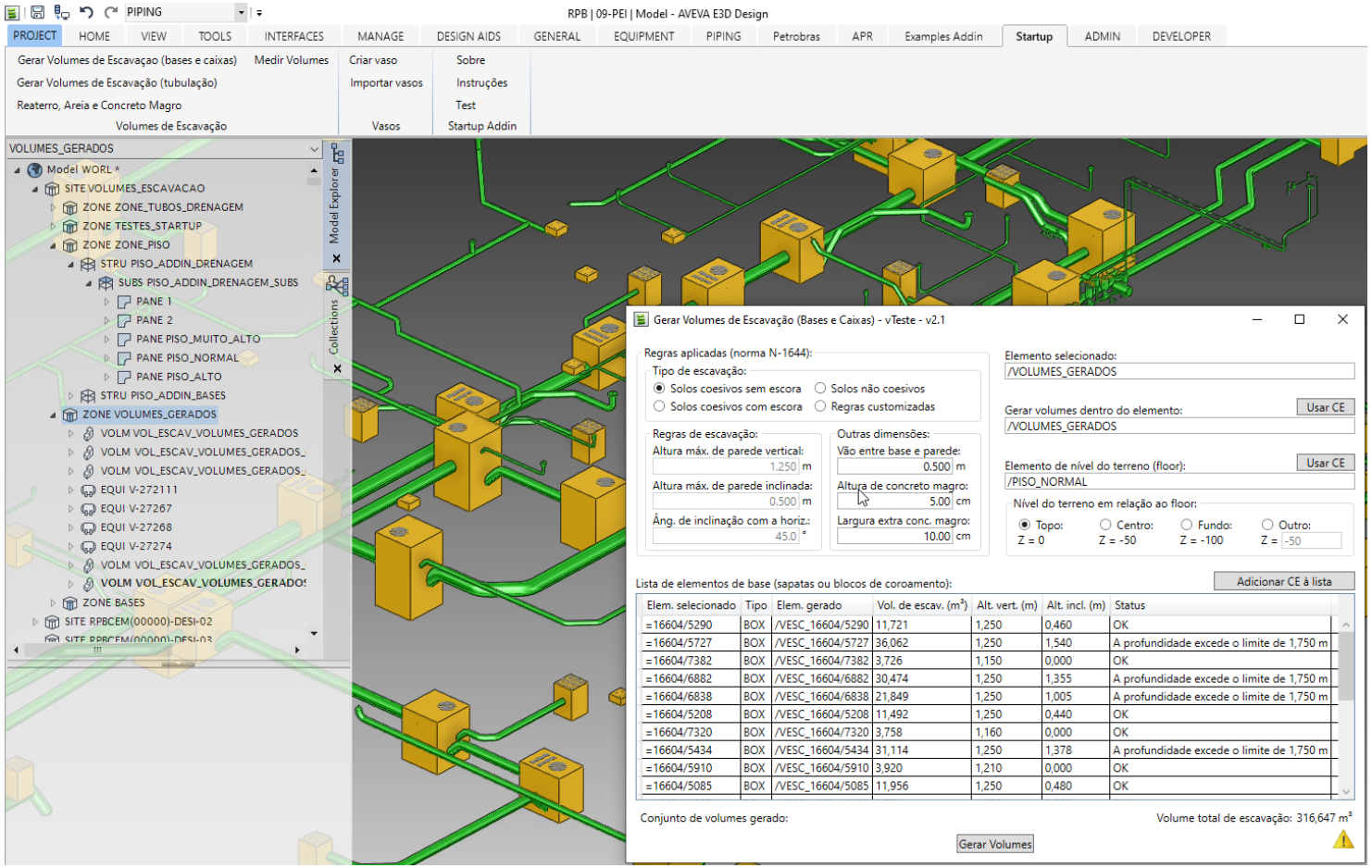
Automatic volume generation - Interactive interfaces



- Interface integrated with AVEVA E3D Design
- Interactive element selection
- Adjustable configurations and rules

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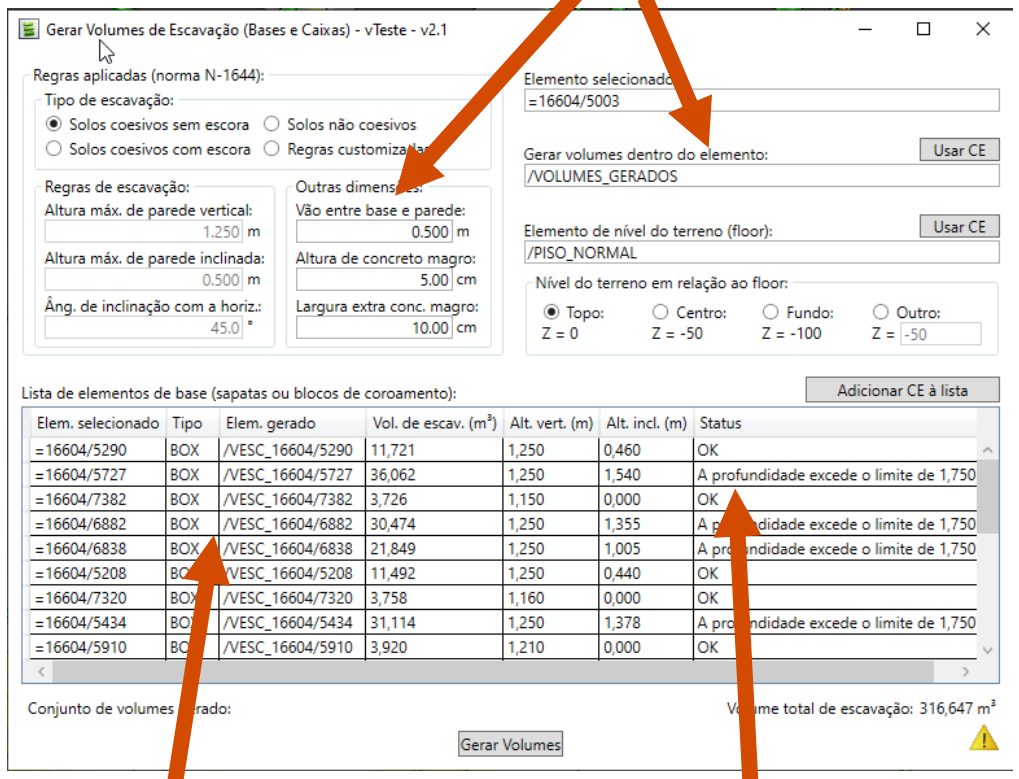
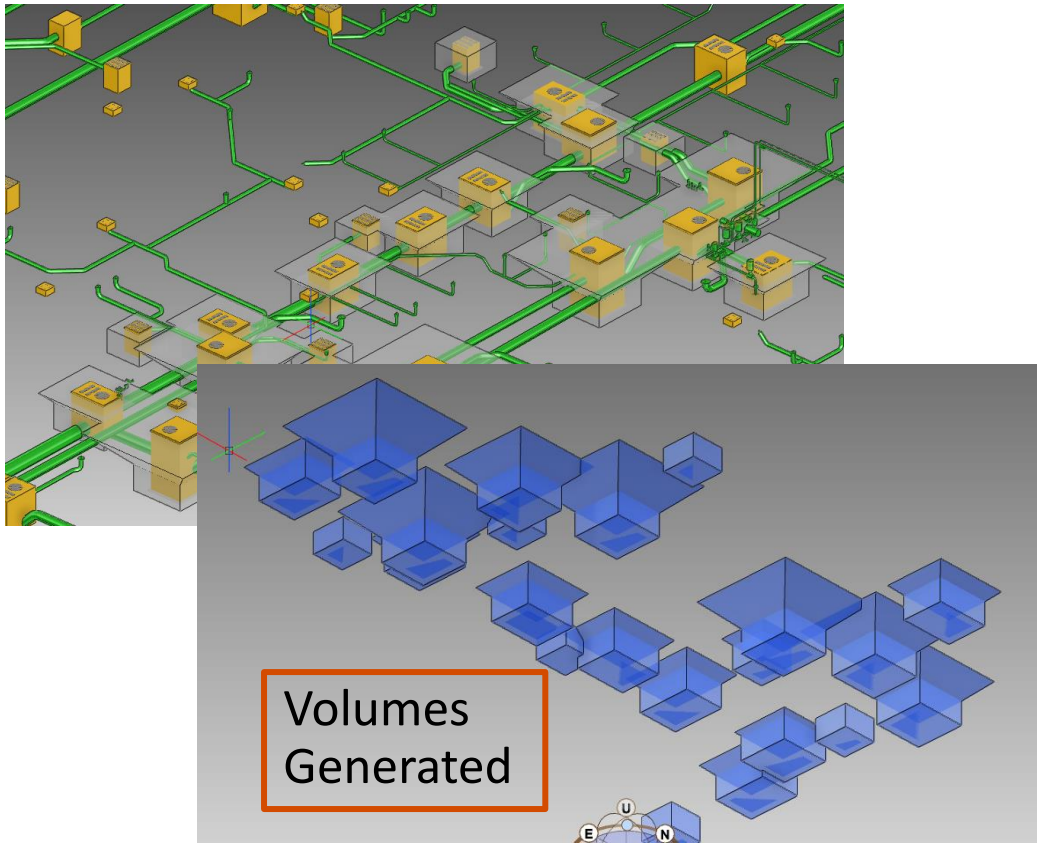
Automatic volume generation - Drainage Boxes

Engineering Rules



Selected elements

Status messages



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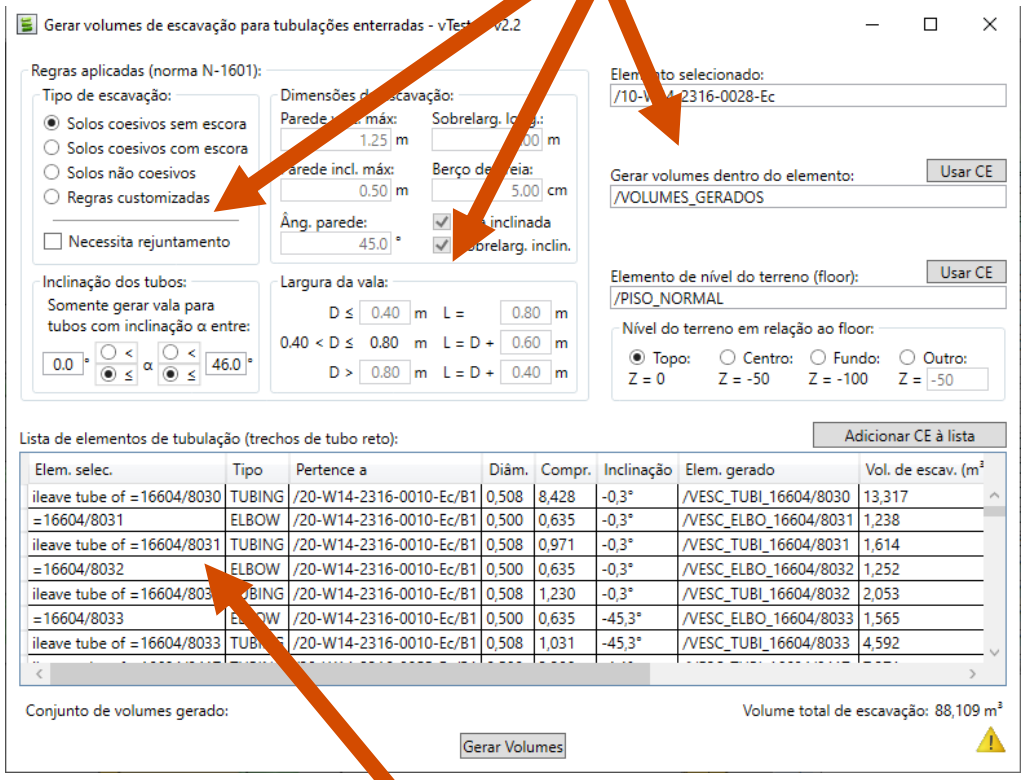
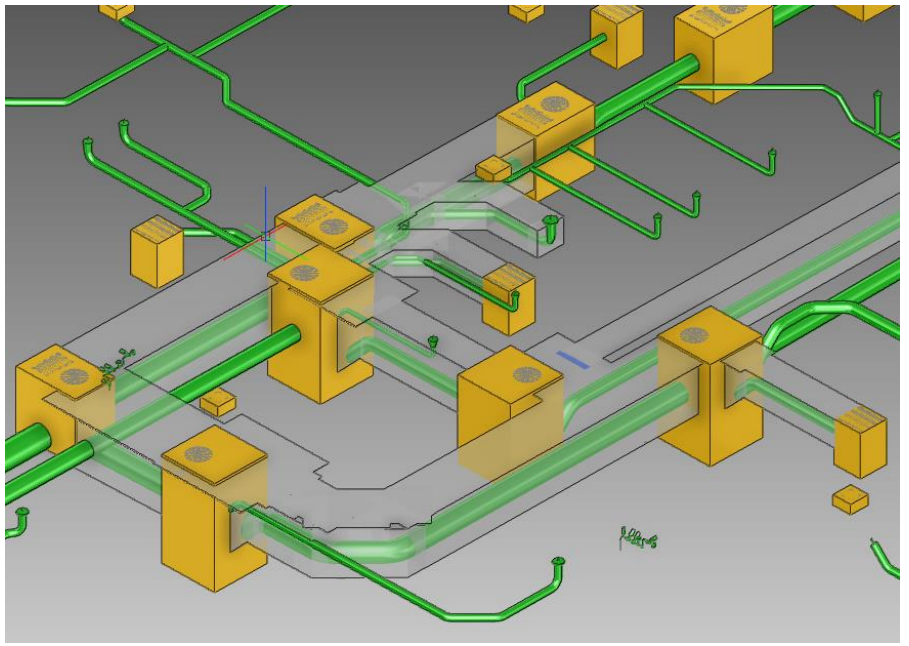
Automatic volume generation - Piping

Engineering Rules



Selected elements



Volumes Generated

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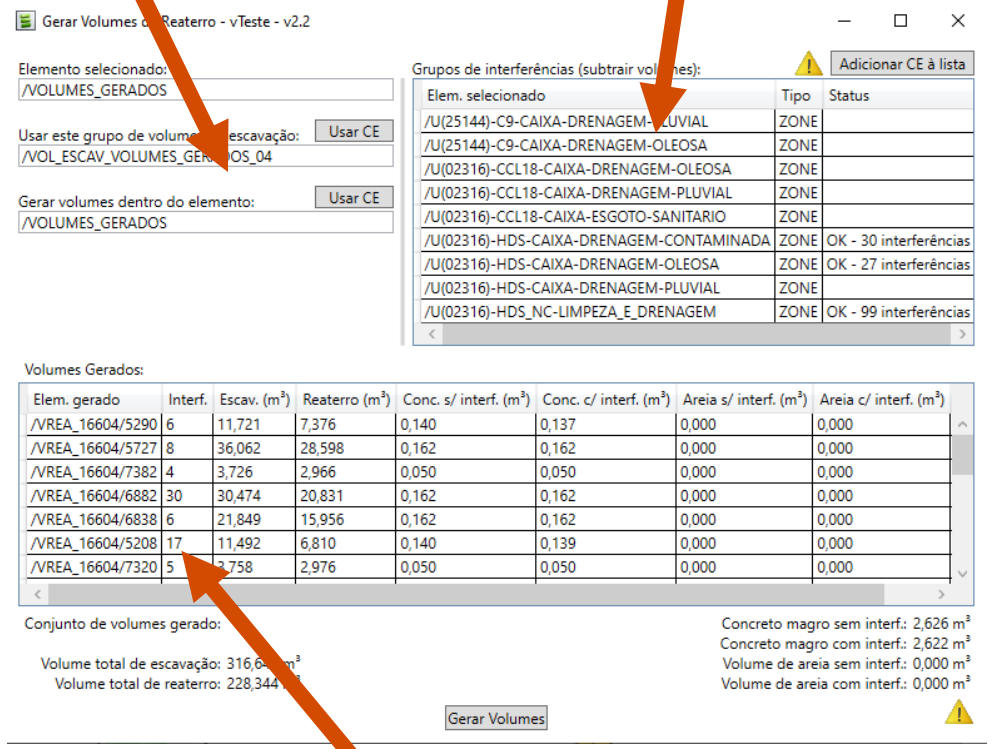
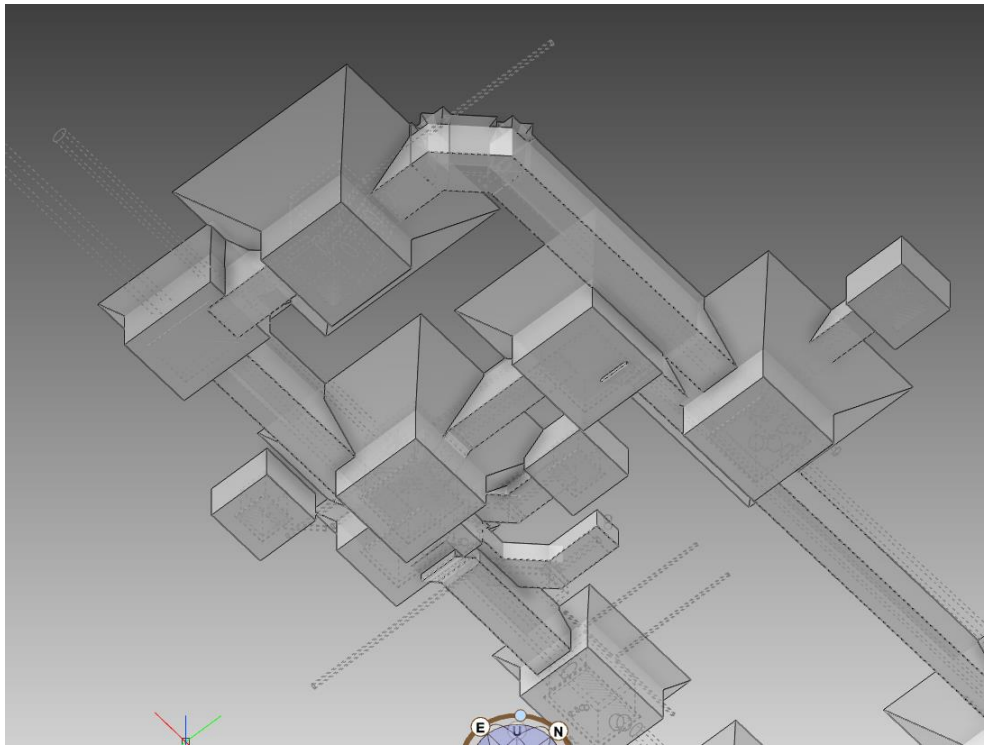
Interference handling - Backfill volume

Selected Volumes

Selected Interferences



Backfill volumes generated



Volumes Generated

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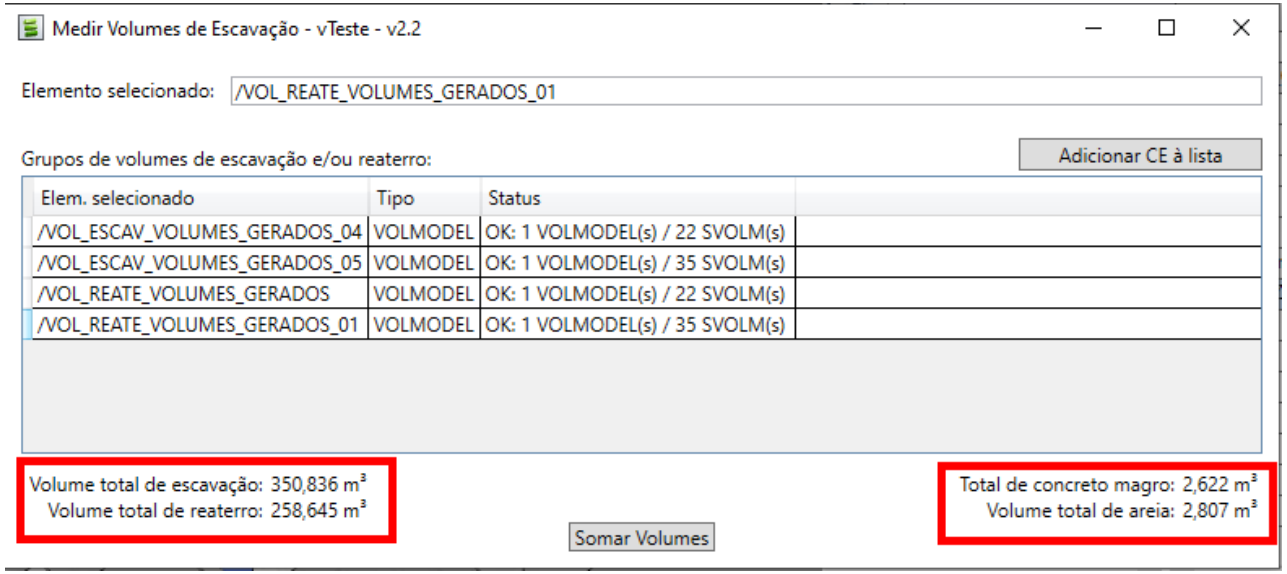
Total volumes sum

Various types:

- Excavation volumes
- Backfill
- Sand and concrete

Advantages:

- Instant calculation
- Handles intersections
- Gain in precision and productivity



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Development of templates and reference projects (substations)

USE CASES - Reference projects

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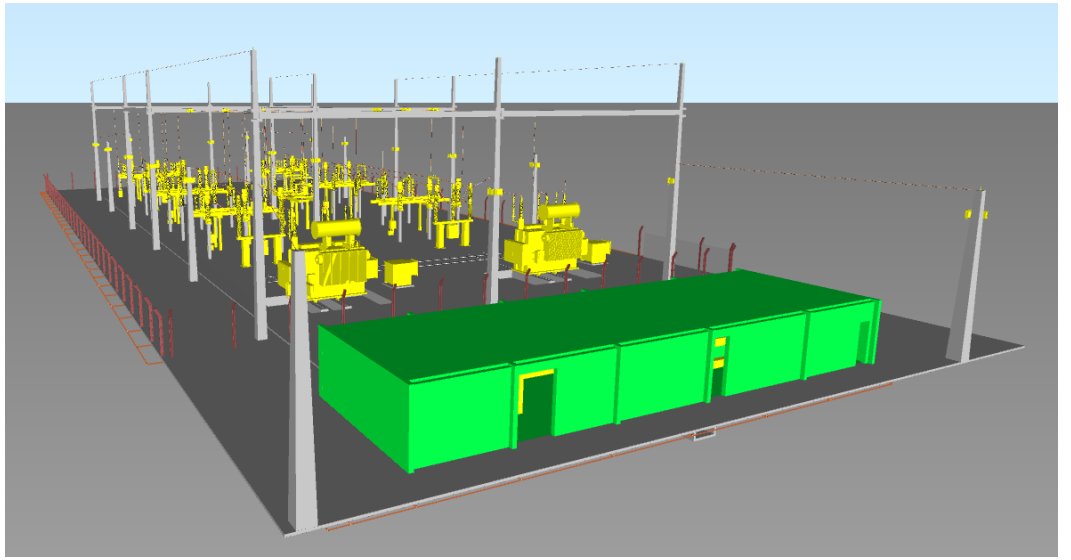
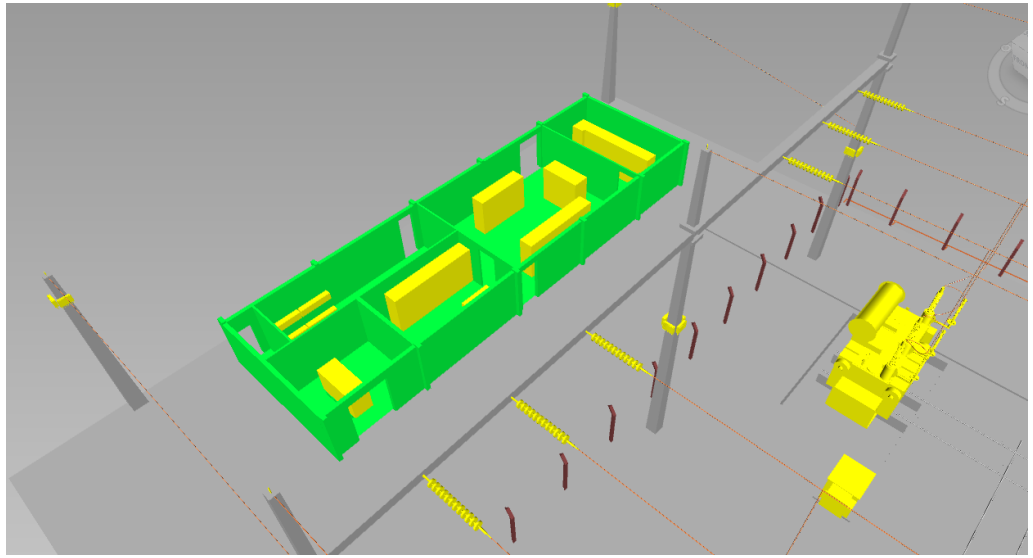
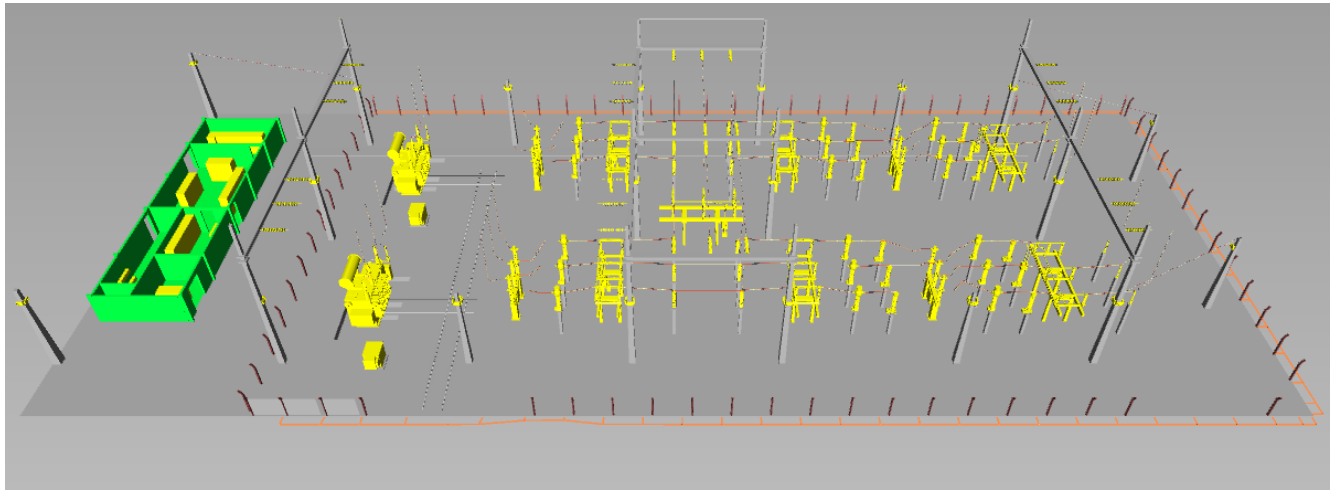
Final Model







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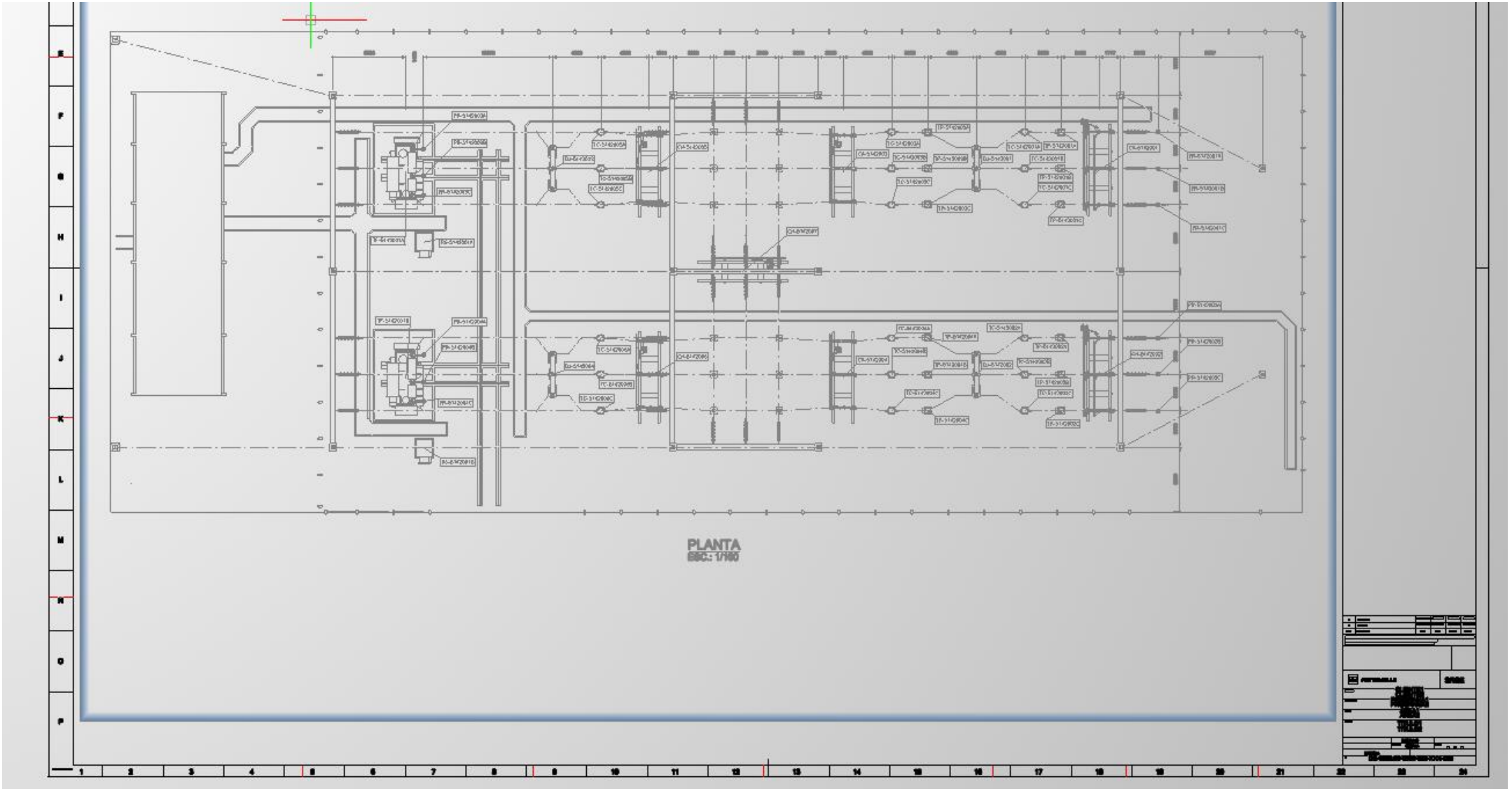
Plants extracted from the 3D reference models



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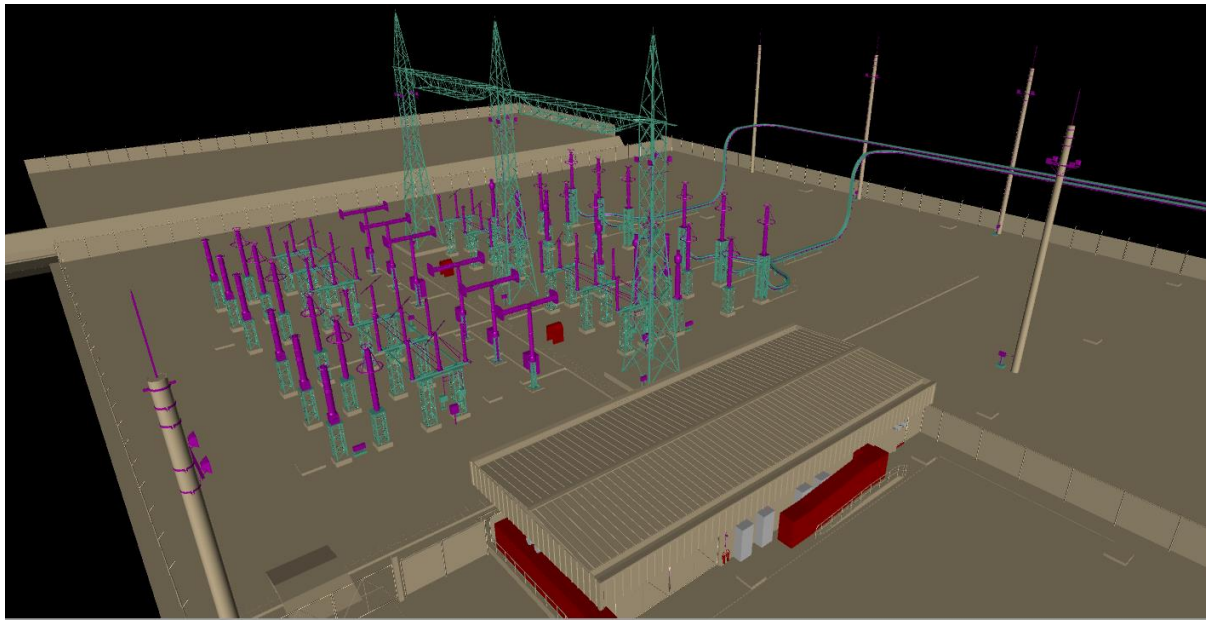
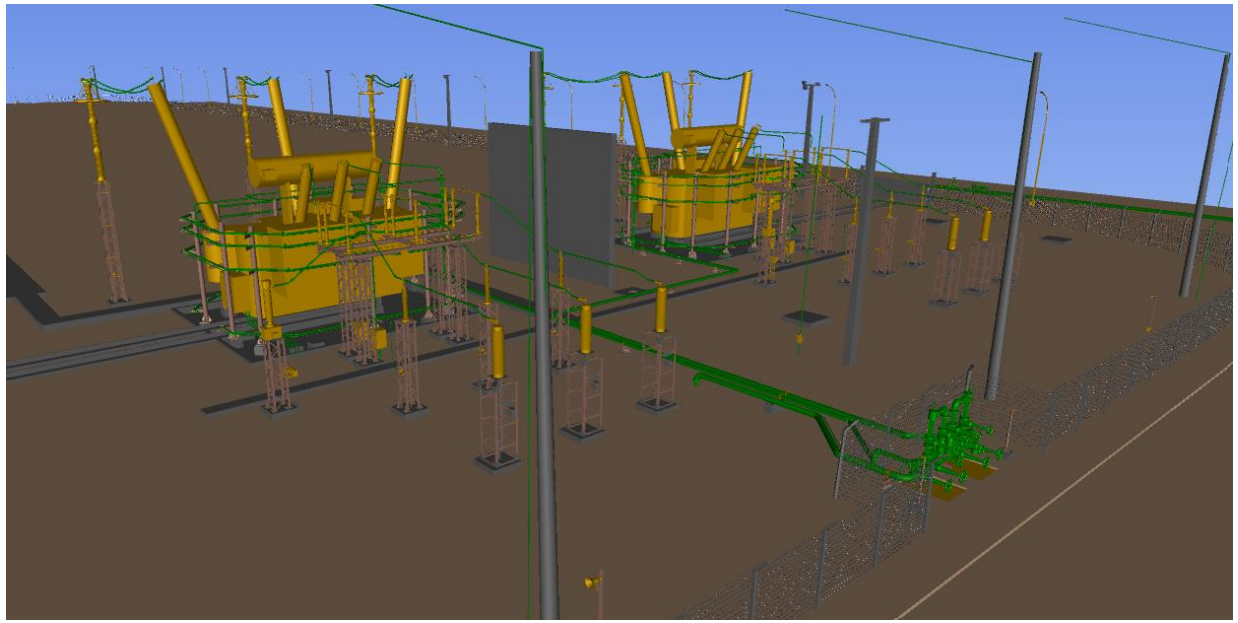
Other Models

SE 345 kV



SE 440 kV



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Other uses of the 3D model during Basic Design

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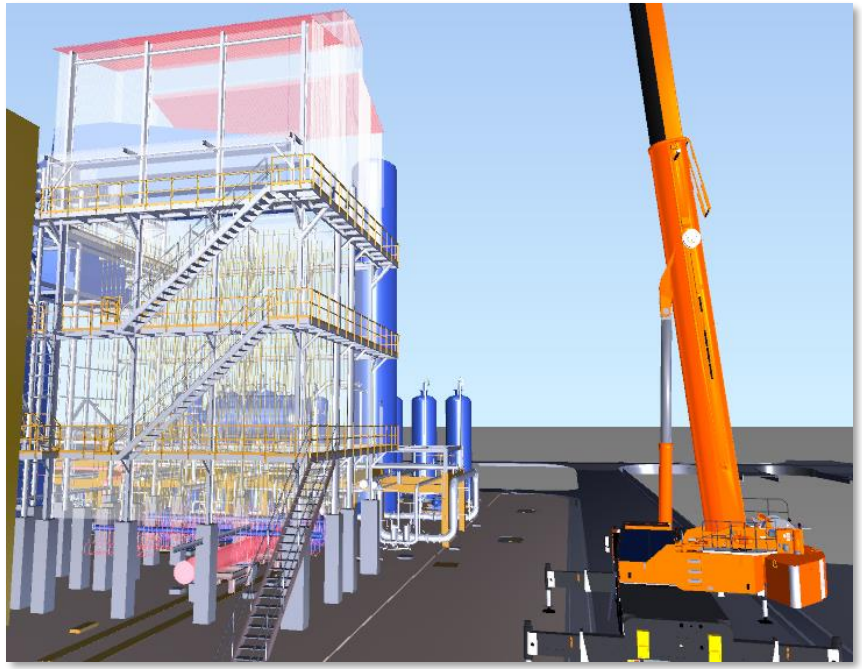
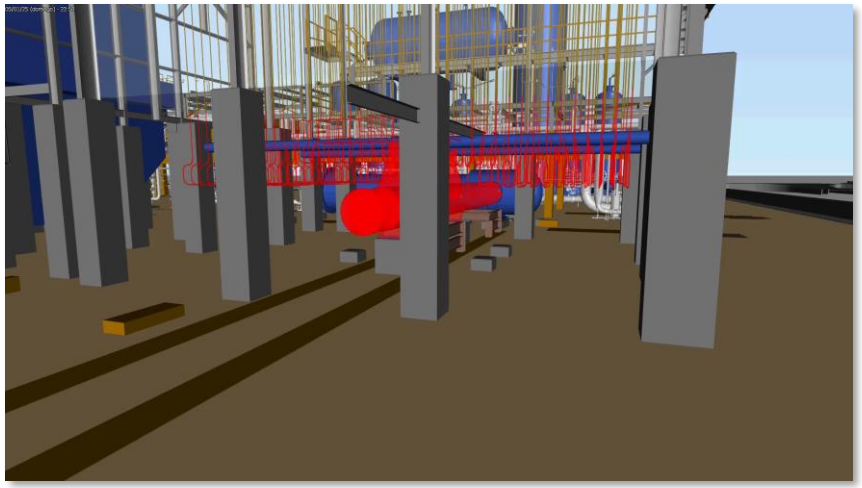
Other uses of the 3D model during Basic Design

- Validation of preliminary planning - 4D



- Simulation of critical activities - to confirm feasibility



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Bidding Phase

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What are the expected gains from providing the 3D Model during the bidding process?

- Clarity on the project scope (Contractual documentation set vs 3D Model)
- Reduce time for quantity take-offs - part of the quantities can be extracted from the 3D model

Important to remember: the basic design 3D does not cover the entire scope

- Reduce uncertainties - less price variation and risk of losing the bidding process

INFEASIBILITY < < MAXIMUM PRICE

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Detailed Design Phase

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Use of Basic Design 3D Model in Detailed Design

- Part of an initial model is contracted - anticipation of detailed design activities in 3D model
- Simulations are possible from day one
- Supervision team arrives with knowledge and familiarity with the project.
- A lower level of rework is expected - anticipation of various comments in the Basic Design Review

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Results

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OIL & GAS | BRAZIL

Petrobras: Achieving Efficiency Gains through 3D Modeling from Basic to Execution

Challenge

- Respect the project maturity level - Basic vs Detailed Design
- Most projects are BrownField, even for new units, there are always interconnections with existing areas
- State of existing documentation: scanned vs 2D vs 3D (PDMS, E3D)
- Multiple scopes: demolition, expansion, adaptations

Solution

- Develop data-centric projects from the early design phases and consolidate the use of the 3D Model from the Basic Design stage, acting as a discipline integrator and in conjunction with laser scanning and point cloud technology.

Results

- **Reduced effort for quantity take-offs (~ 80% reduction)**
- **Early analysis (operation, maintenance, planning, constructability)**
- **Greater clarity on project scope during Bidding**
- **Accelerated start of Detailed Design**

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Next Steps

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Next Steps

- Develop more integrations between Specialized Tools and Project Databases
  - Testing with AVEVA Engineering
- Expand extraction of documentation and quantities directly from project databases

In the future...

- Replace 2D basic design documents (plans, sections and views) with the 3D model itself
- Better interoperability for integration between AVEVA E3D and BIM Models

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