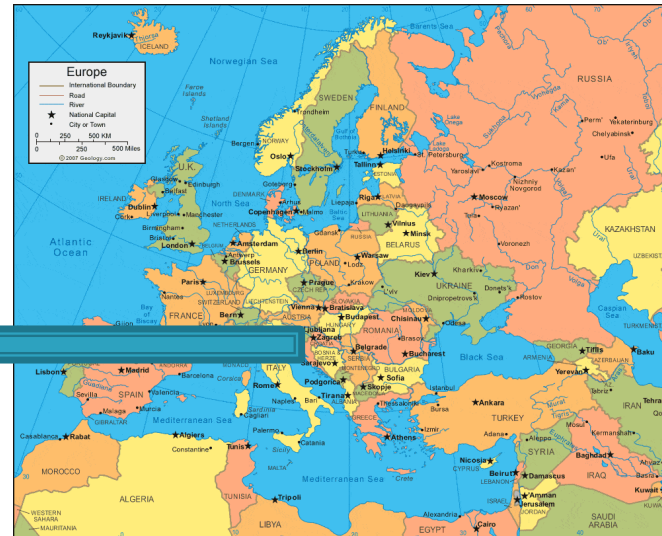




**FRACTAL d.o.o.** POWER SYSTEM ENGINEERING AND CONSULTING

Kupreška 37, 21000 SPLIT | [www.fractal.hr](http://www.fractal.hr) | [fractal@fractal-res.com](mailto:fractal@fractal-res.com)

**BANK ACC (IBAN):** HR0223600001101402645 | **PIN (VAT):** 05342281198



# FRACTAL d.o.o. Split, Croatia Company presentation

10/2024



**FRACTAL d.o.o.**  
[www.fractal.hr](http://www.fractal.hr)

Renewables & Power system engineering and consulting



Company **FRACTAL d.o.o.** Split was founded in 1994 with power system engineering software development as a primary business area.

Today, there are four main areas of activity:

- **Services and consulting in renewable energy projects development, construction and operation (mainly wind and solar)**
- **Consulting in power system engineering**
- **Design of power plants and transmission/distribution facilities**
- **Software in power system engineering**





## Partners – gather the experts to offer full service

- ❑ Company founders, professors at the University of Split (FESB):
  - Ranko Goić, PhD (power system engineering)
  - Eugen Mudnić, PhD (computer science)
- ❑ CEO:
  - Ante Tojčić, MSc (power system engineering)
- ❑ Full turnkey engineering services in RES projects in all stages: development, tendering&contracting, acquisitions, construction and operations:
  - swift performance
  - single line of responsibility
- ❑ Specific projects (complex studies, projects and research activities) in the field of power systems, can be conducted through the Faculty, in order to meet client's needs.



UNIVERSITY OF SPLIT  
FACULTY OF ELECTRICAL ENGINEERING, MECHANICAL  
ENGINEERING AND NAVAL ARCHITECTURE





# Company structure/departments

Ranko Goić, PhD  
Eugen Mudnić, PhD

Majority owners

Ante Tojčić, MSc

CEO

## Departments

Wind and solar  
measurement & analyses

Design  
(civil, electrical)

Construction management  
and supervision

Power system analyses,  
grid connection and grid  
compliance

Operation/asset  
management and O&M

Tendering and contracting,  
due diligence, feasibility

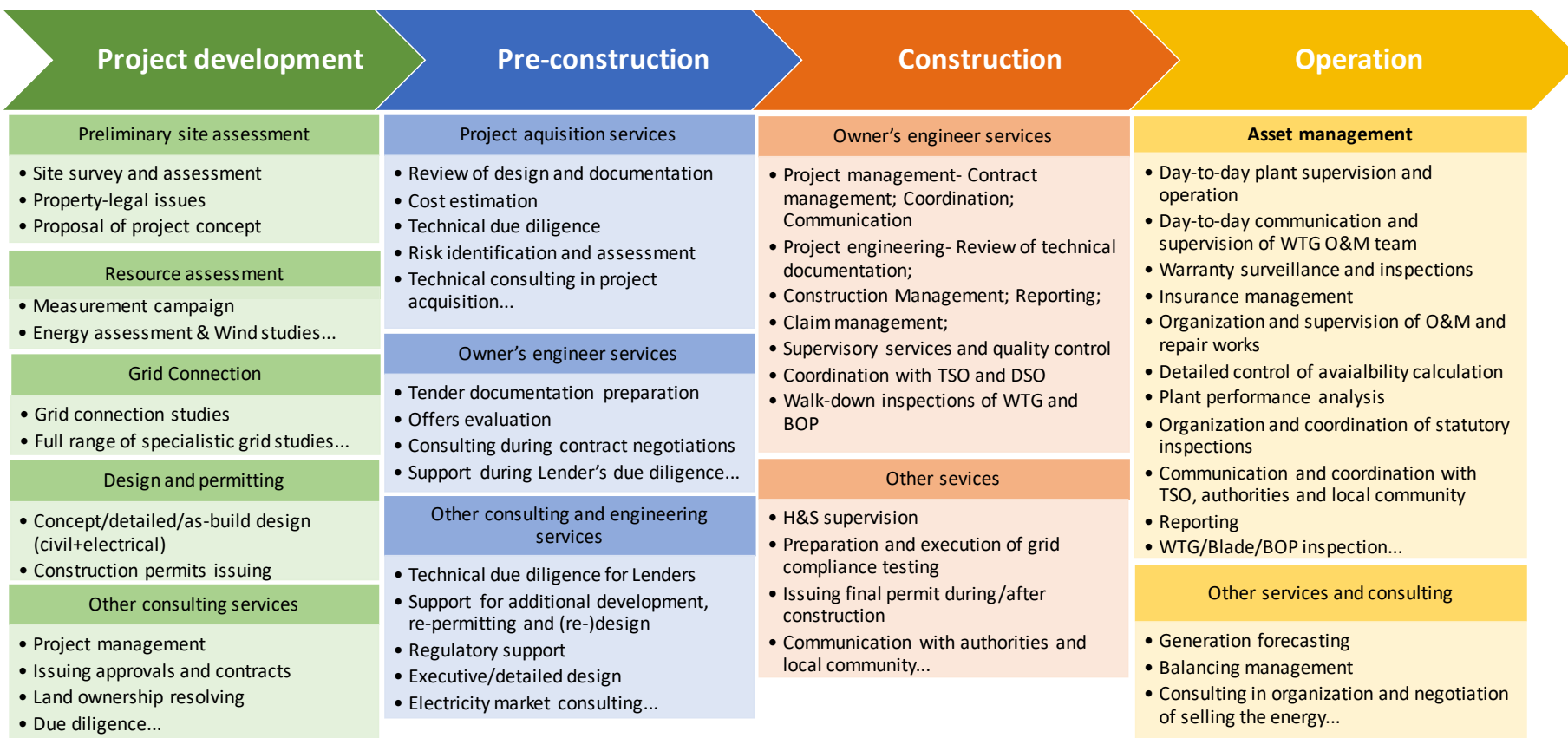
Project development

Architectural and civil  
engineering





# Services in wind/PV/battery storage:





# Services in project development & permitting:

## ❑ Initial activities in project development

- Site survey, identification of limitations, constraints and surrounding infrastructure
- Zone plans review
- Environmental assessment and risks review
- Cadastre and land ownership investigation
- Preliminary energy resource assessment
- Complete preliminary site assessment
- Preliminary concept design of power plant and grid connection
- Preliminary cost assessment



## ❑ Obtaining approvals / contracts

- Consulting and support in process of obtaining approvals, communication with all relevant institutions
- Preparing documentation for issuing concessions and specific energy approvals
- Obtaining location, building and other construction permit, grid connection approvals/contracts and Power purchase agreement (PPA)
- Support in resolving and contracting property-legal relations
- Project management throughout development process



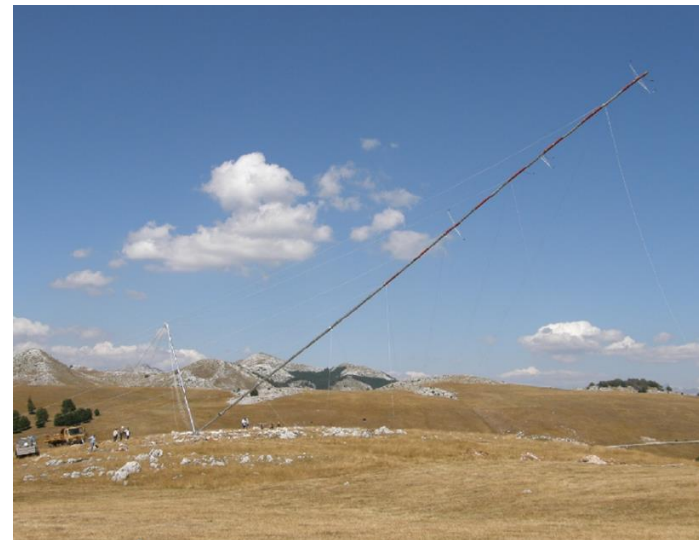
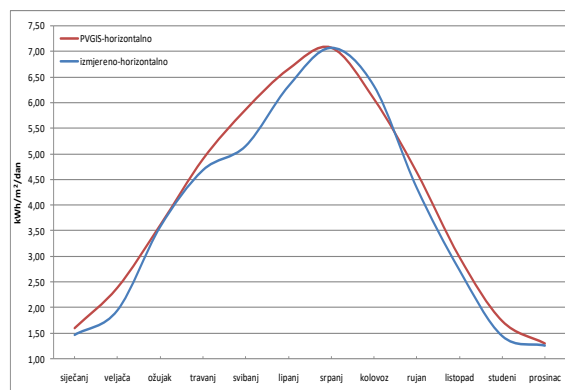
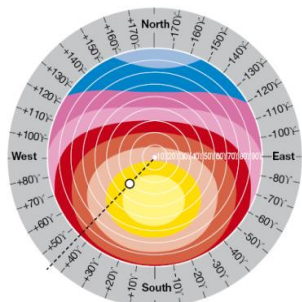


# Wind/PV resource assessment (1)

## ❑ Wind measurement

## ❑ Solar radiation measurement

- Met mast / meteo station siting and obtaining permits
- Equipment specification, supply, installation, commissioning
- Met mast and equipment maintenance
- Wind data monitoring/management
- Periodic reporting and preliminary energy assessment

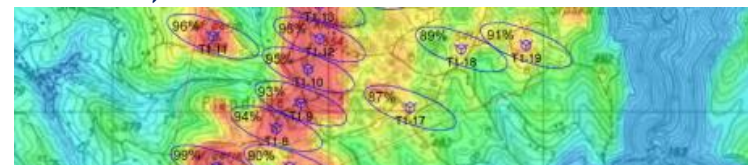
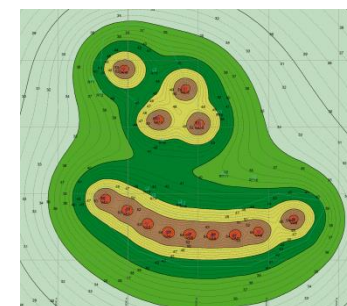
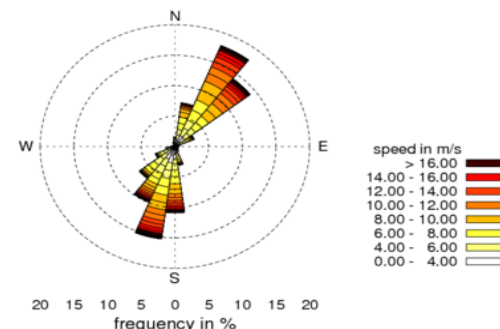
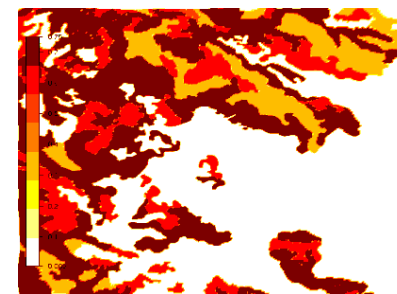




# Wind/PV resource assessment (2)

## □ Wind/PV resources and energy yield assessment

- Site visit and terrain assessment
- Digital 3D terrain modelling, roughness and obstacles mapping
- Measurement data and long term reference data quality assessment, statistical analysis
- Long term prediction using standard MCP methods, determining the uncertainties (IEC61400-12)
- Wind flow modelling, site wind energy map, assessment of extreme and normal wind conditions
- Wind farm layout optimization, final micro-sitting
- Estimation of the annual energy production (AEP), array and other losses, calculation of exceedance probabilities values
- Assessment of sound emission, shadow flicker analyses, ZVI, visibility
- Analysis of production for WF/PV in operation
- Using renowned and latest specialised software (WindPRO, WAsP, Windographer, Pvsyst, own software ...)

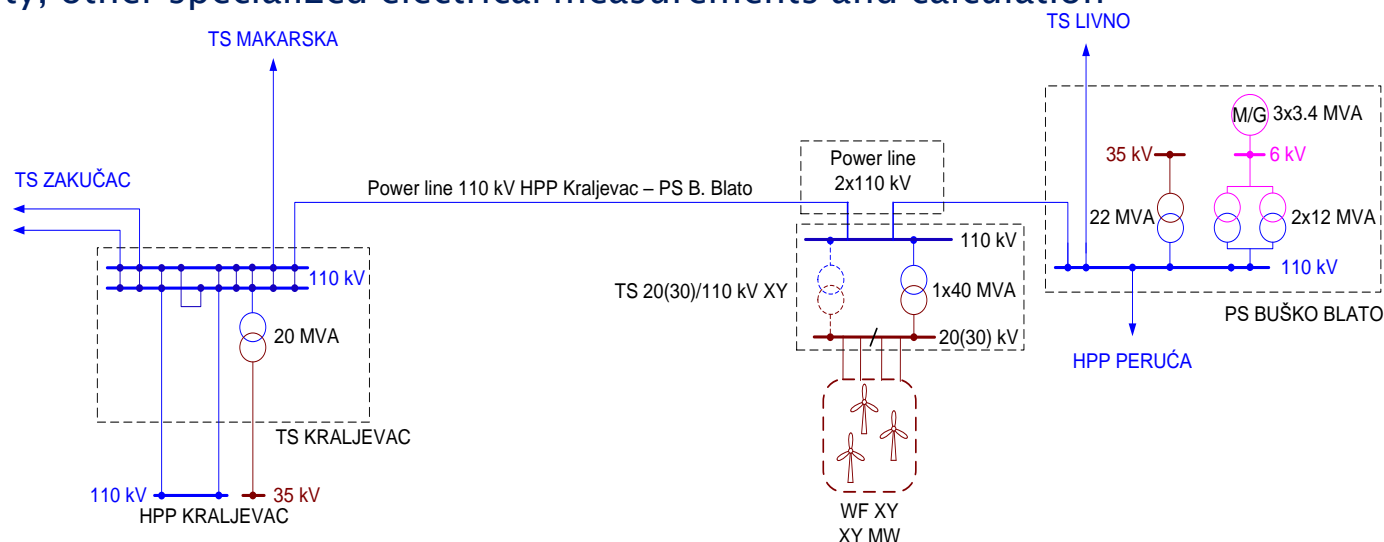




# Grid connection

## ❑ Services regarding the grid connection of power plants

- Preliminary grid connection assessment and consultation
- Grid connection design and optimization
- Studies required for grid connection approval
- Specialized grid connection analysis and studies
- System studies and studies for wind (renewables) grid integration
- Consultation, communication with grid operator and management of the complete process of obtaining grid connection permits/contracts
- Testing of WF grid compliance during trial operation, measurements and analyses of power quality, other specialized electrical measurements and calculation





# Due diligence and acquisitions

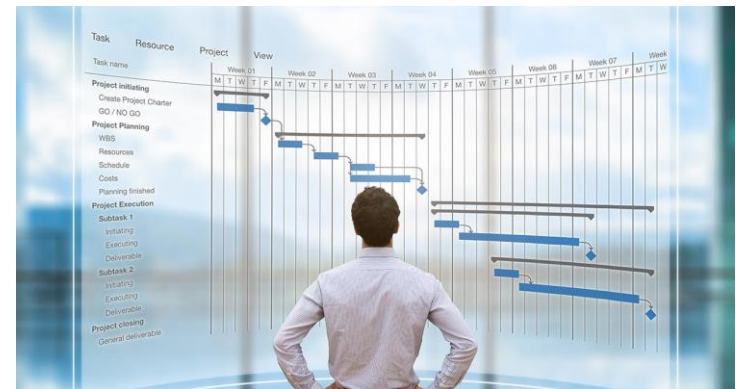
- Detailed Due Diligence for acquisitions, including regulatory, permitting and land issues
- Detailed Due Diligence for financing
- Risk identification, analysis and proposal of mitigation measures
- Local market analysis
- Cost estimation
- Verification of wind measurements, wind resource and energy yield study, adequacy of wind turbine etc.
- Review of WTG supply, PV EPC and O&M agreements
- Review of BOP and other project agreements
- Consulting during SPA and SHA preparation and negotiation process





# Owner's engineer services in contracting phase (tendering&contracting)

- Review of design, permits, contracts and other technical documentation
- Preparation of tender documentation for construction (Wind turbines, Balance of Plant, Photovoltaic EPC and equipment, battery storage)
- Preparation of tender documentation for asset/operational management and maintenance (Wind turbines O&M, BOP O&M, PV O&M, battery storage O&M)
- Evaluation of proposals, contracts negotiation
- Tendering, evaluation and contracting of key equipment
- Review of third party documentation
- Assessment of local contractors
- Technical consulting during contracting of financing with Lenders
- Construction planing and scheduling
- Construction site planning and permitting





# Services during construction (1)

Full Owner's Engineer services/Construction management, or partial services:

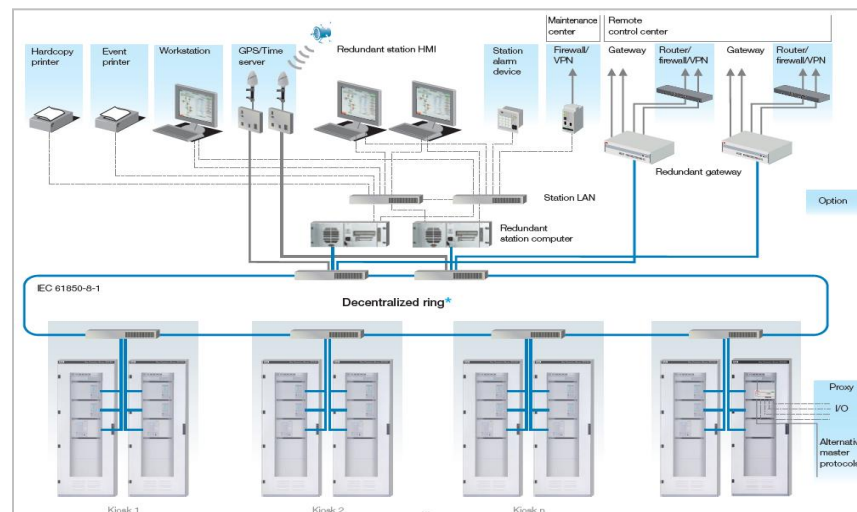
- Detailed/executive design, As-built design
- Site supervision services
- H&S services
- Quality control
- Detailed technical inspection after construction (walk-down)
- Obtaining necessary permits and approvals during and after construction
- Coordination and communication with relevant institutions (TSO, DSO, inspectors, authorities,...)





## Services during construction (2)

- EPCM services during construction for WF and large PVP (service under development)
- EPC for PV rooftop and hybrid systems
- Site engineer services
- Functional testing and commissioning of secondary systems in substations LV-MV-HV and power plants
- Relay Protection settings/configuration/testing
- Primary testing of CTs, VTs and CBs
- SCADA/Control configuration, commissioning and testing
- RTU configuration, commissioning and testing
- Measurements in substations and power plants

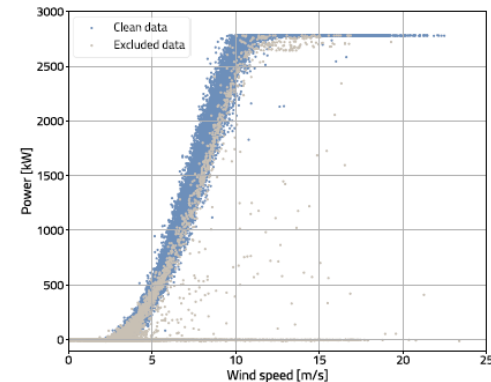




# Services in operation (1)

## ❑ Operation (asset) management of WF and PV plants

- Day-to-day WF/PV real-time monitoring and control
- Organization and supervision of servicing, maintenance and repair works by third parties
- Control of SPV's all contractual obligations, including management and control of warranties
- Insurance management
- Management and execution of all SPV's contractual and statutory obligations
- Contacts and communication with local community and all authorities
- Document management
- Availability calculation control (or re-calculation) and alignment with WTG/PV O&M Contractor
- Technical analysis of WF/PV performance
- Production optimisation
- Troubleshooting
- Periodical technical inspections of WTGs, PVPs, BOP





# Services in operation (2)

## ❑ WF BOP O&M, PV O&M

- Planned maintenance and statutory inspections
- Unplanned maintenance/repairs
- Spare parts management
- Switching and other operations in substations
- Periodical technical inspections of WTGs, PVPs, BOP
- Full HSE services
- Reporting
- Communication and coordination with TSO/DSO and authorities
- WTG maintenance and control (service under development)

## ❑ Other services

- Technical and legal support in electricity trading (contracting and operation)
- Generation forecast and balancing management
- Technical inspections, defects identification and root-cause analysis of WTGs, PVPs, BOP infrastructure





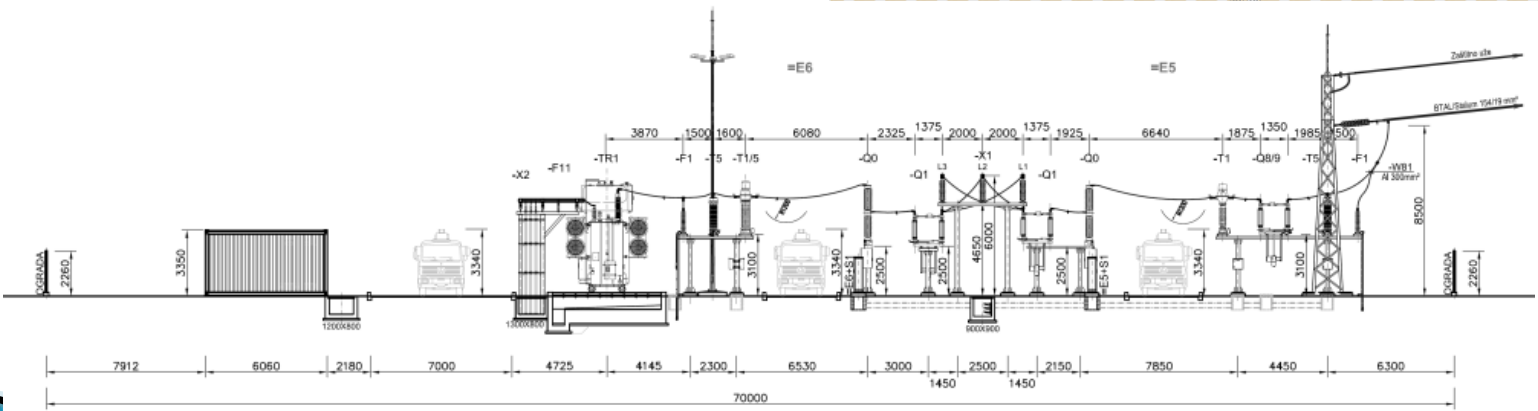
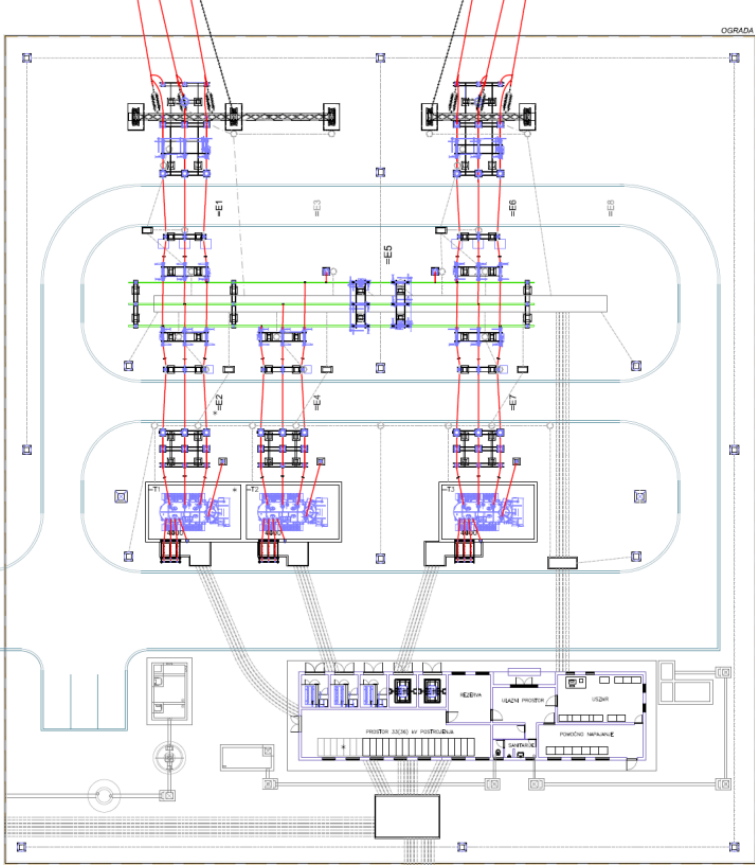
# Design, Engineering

## □ Design documentation

- Preliminary, concept, pre-construction, detailed, as-built design
- From low-voltage to high voltage (400 kV)
- Civil/Electrical
- Detailed cost estimation / bill of quantities

## □ Other

- Documentation required for obtaining various permits/contracts/approvals for construction
- Third party design review and optimization





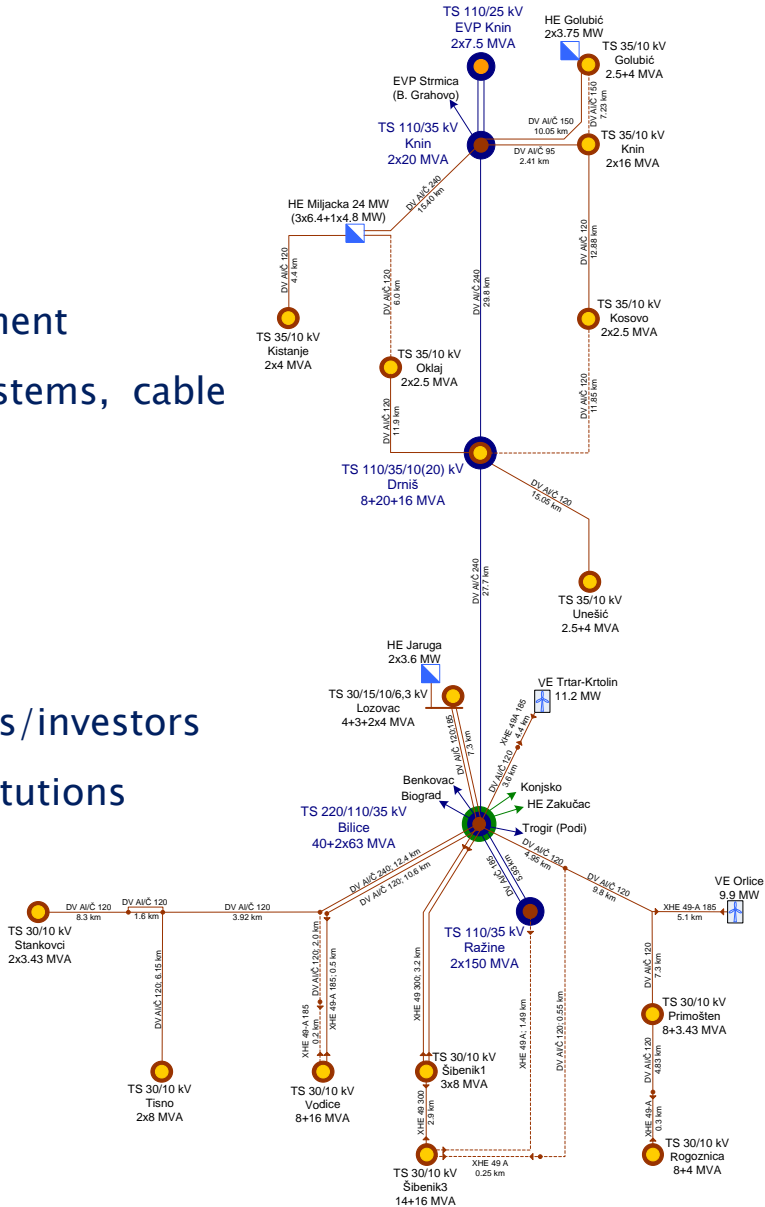
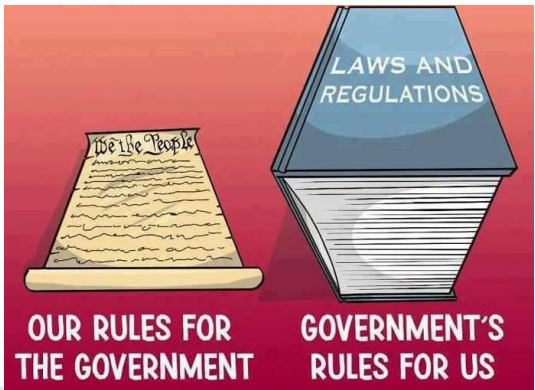
# Other services (1)

## Services in Power system engineering

- Power system analysis and optimization studies
- Power system measurement
- Transmission and distribution network development
- Relay and overvoltage protection, earthing systems, cable systems calculations, transient analysis
- System impacts of wind/PV integration
- Smart grid

## Regulatory consulting

- Energy related regulatory consulting – developers/investors
- Energy related regulatory consulting – State institutions

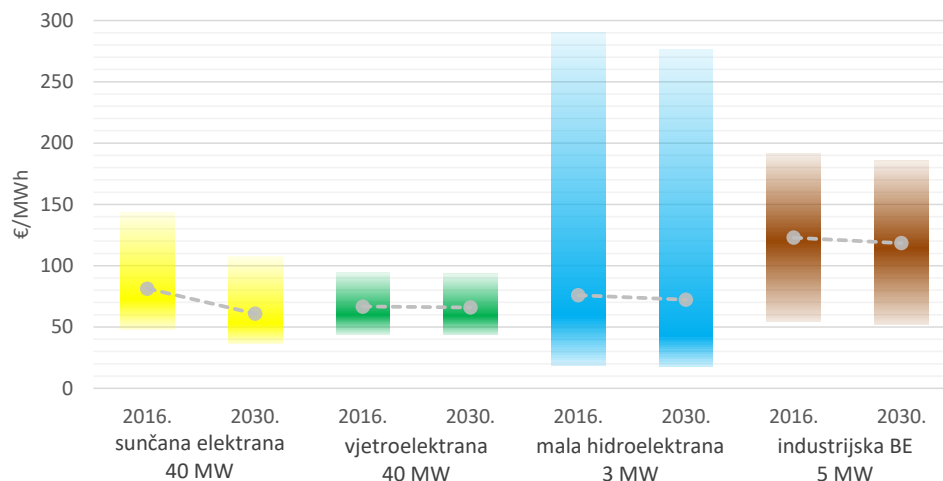
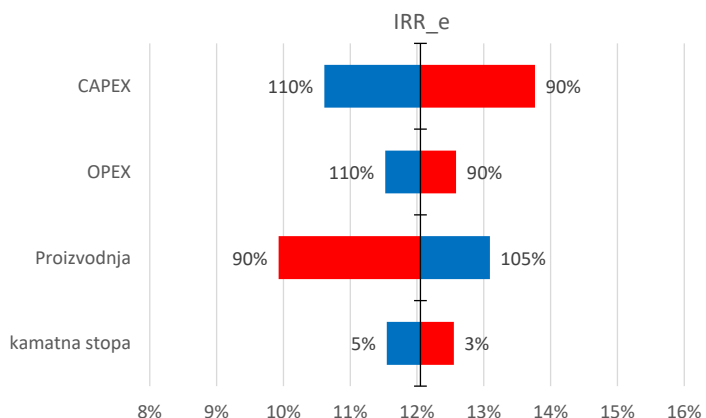
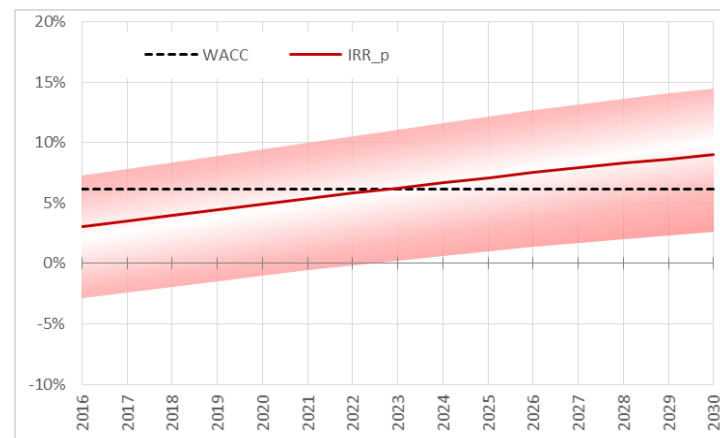




## Other services (2)

### □ Technical and economical assessments

- Prefeasibility/Feasibility studies
- Risk assessments, Risk management
- Project/portfolio assessment and evaluation
- Power market analysis and consulting (wholesale power market, balancing market, PPA consulting etc.)

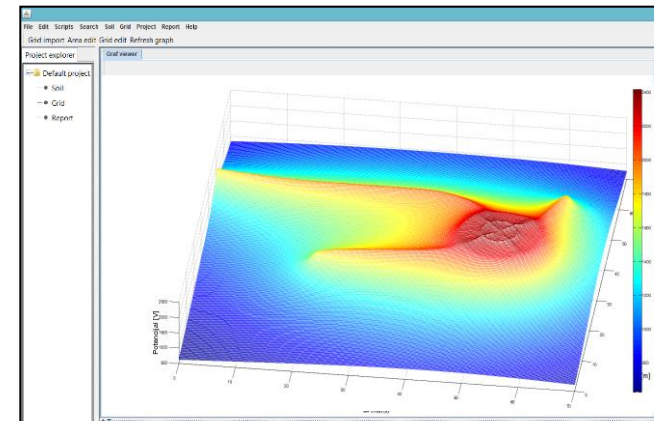
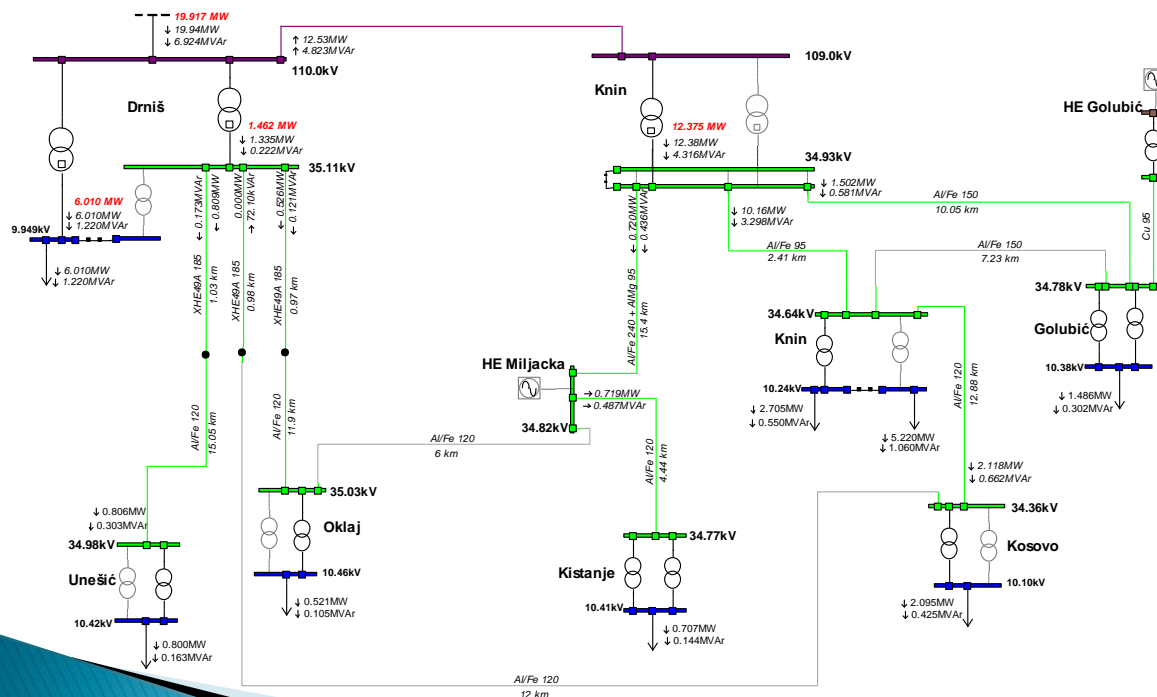




## software

☐ Own software

- PowerCAD: Software for load flows and short circuit in HV/MV grid
- WINdis: Software for low-voltage distribution networks calculations
- D-PLAN: Software for power system short-term planning/scheduling
- Wind and solar forecasting
- Wind turbine/WF performance analysis





**Clients:**

- ABB d.o.o.
- Acciona Energia d.o.o.
- Akuo Energy med
- Aiolos projekt d.o.o.
- Aureus Solis d.o.o.
- C.E.M.P. d.o.o.
- Cemex Hrvatska d.d.
- CJR Renewables
- Dalekovod d.d.
- Dalekovod Projekt d.o.o.
- E-ulaganja d.o.o.
- Energetski park Korlat d.o.o.
- Eko-energija d.o.o.
- Electrawinds K-Wind d.o.o.
- Elektrozapad d.o.o.
- Eling-projekt d.o.o.
- Emek HaBacha Wind Energy Ltd.
- Encro d.o.o.
- Energija projekt d.o.o.
- Enlight Renewable Energy Ltd
- Enlight K2 – Wind d.o.o.
- EKO d.o.o.
- EP inženjering d.o.o.
- Fichtner
- Flamtron d.o.o.
- FL Wind d.o.o.
- Generacion eolica castilla la mancha SL
- General Electric
- Georgian renewable power company
- HELB d.o.o.
- HEP d.d.
- HEP OIE d.o.o.
- HOPS d.o.o.
- HEP ODS d.o.o.
- HEP Proizvodnja d.o.o.
- Hitachi Energy
- Imres d.o.o.
- Impol-TLM d.o.o.
- Interenergo d.o.o.
- Inero d.o.o.
- Ivicom Consulting GmbH
- JSC Caucasian Wind Company
- JP Elektroprivreda HZ HB d.d.
- JP Elektroprivreda BiH d.d.
- Krnovo Green Energy d.o.o.
- Končar – KET d.d.
- Končar – Obnovljivi izvori d.o.o.
- Jura energija Svilaja d.o.o.
- Kamen-dent d.o.o., Mostar
- Lika Feniks d.o.o.
- Masdar Taaleri Generation d.o.o.
- Megújulóház Kft
- MCC ekskluzivne nekretnine d.o.o.
- MO-BO d.o.o.
- Navitas Solis d.o.o.
- New Energy Solutions d.o.o.
- NORINCO International Cooperation Ltd.
- Nova energija d.o.o.
- Oštra Stina d.o.o.
- Osinium d.o.o.
- Poštak d.o.o.
- Projektni biro Split d.o.o.
- Raaba ACDC Kft
- Raaba Green Kft
- Relax d.o.o.
- Renovato d.o.o.
- RP Global d.o.o.
- RUACH BERESHEET LP
- SE Benkovac d.o.o.
- SE Bili brig d.o.o.
- SE Kolarina d.o.o.
- SE Rašević d.o.o.
- SE Šestanovac d.o.o.
- Shanghai Electric Power Engineering
- Solarna elektrana Bukovica d.o.o.
- SOWI KOSOVO L.L.C.
- Sunčana elektrana Vis d.o.o.
- Tudić elektro centar d.o.o.
- Tullynamoyle Wind Farm 3
- TEC obnovljivi izvori d.o.o.
- Vetroelektrane Balkana d.o.o.
- Vjetroelektrana Bruvno d.o.o.
- Vjetroelektrana Glunča d.o.o.
- Vjetroelektrana Crno brdo d.o.o.
- Vjatroelektrana Ljubač d.o.o.
- Vjetroelektrana Lukovac d.o.o.
- Vjetropark Jasenice d.o.o.
- Vjetroelektrana Katuni d.o.o.
- Vjetroelektrana Orjak d.o.o.
- Vjetroelektrana Opor d.o.o.
- Vjetroelektrana Pometeno brdo d.o.o.
- Vjetroelektrana Ponikve d.o.o.
- Vjetroelektrana Rust d.o.o.
- VRDOVO reverzibilne hidroelektrane d.o.o.
- Wind seek d.o.o.
- WPD Adria d.o.o.
- **Many more...**





