



# DESIGNING POWER TRANSMISSION SYSTEMS

COMMITMENT EXPERTISE SOLUTIONS

# COMMITMENT

“We build strong operator-to-operator relationships to support our clients.”

## A HIGH-QUALITY RELATIONSHIP MAKES ALL THE DIFFERENCE

at a time when power systems are being transformed in response to the world energy context, with changes in the energy mix, integration of renewable and conventional energy sources, introduction of smart grids and increasing number of interconnection. The challenges faced by each country or region are different, but the move to achieve greater sustainability is global. The EDF Group leverages its integrated organisational structure to provide the best solutions for local energy policies around the world. Our grid engineering expertise covers power plant connection, switchyards and power transmission systems. We build on our comprehensive knowledge of systems to forge close operator-to-operator relationships with our customers and provide standout support at each stage of their projects. The independence and strength of our Group further enhances this support.



**Jean-Paul Mairesse,**  
Director of EDF's Transmission  
System Engineering Centre (CIST)

## OUR ACHIEVEMENTS

**93%**  
of satisfied clients  
(since 2011)

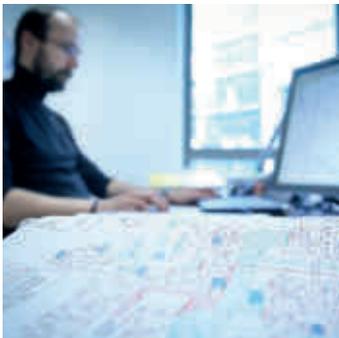
### AMERICAS

#### French Guiana

Project management assistance for the SYSCODOM control centre system upgrade (design, supply, installation and commissioning of the new control systems, operator training)

#### Guadeloupe-Martinique

Project management assistance for the completion of the Fond Laillet and Pointe Jarry power plant switchyards



#### Jamaica

Study of the impact of renewable energy integration on the Jamaican transmission system. **Findings:** the goal of 30% generation from renewables by 2030 is achievable, suitable sites have been identified and the costs have been calculated.

## EUROPE

### Andorra

Design of 5 km of underground lines and EHV substations

### France

Contract study with the TSO for an offshore wind farm project / Design and supervision of the 400 kV gas-insulated switchyard of the 1,600 MW Flamanville EPR

### Poland

Detailed design study for the connection of a 900 MW supercritical coal-fired plant

### Russia

Network studies for the Murmansk tanker terminal

### United Kingdom

West Burton combined cycle gas turbine (CCGT) switchyard, from design right through commissioning



1

### Sardinia-Corsica-Italy

Design of the HVDC (High Voltage Direct Current) converter station as part of the implementation of the world's first high-voltage direct current three-terminal link (264 km of overhead lines and 121 km of +/- 200 kV DC underwater cables)

2

### United Kingdom

Design of the technical interface for the Hinkley Point nuclear power plant connection with the National Grid

3

### Qatar

Supervision study and implementation for the new Qatar control centre to strengthen operation of the national distribution grid

4

### United Arab Emirates

Commissioning and operation studies for the interconnection of the electricity grids of the UAE countries and the harmonisation of load shedding plans

5

### Mayotte

Study, design and tendering for Mayotte's first 2 x 90 kV line, which meets environmental standards

## AFRICA

### Burkina Faso

Bobo-Dioulasso-Ouagadougou interconnection (360 km of overhead lines, three 225 kV substations, four 90 kV substations)

### Cameroon

Protection study / Detailed study of the switchyard and the 225 kV power line for the Nachtigal hydroelectric power plant

### Cape Verde

Network study to optimise the wind and fossil-fired generation fleet

### Djibouti

63 kV substation and control centre supervision

### Egypt

Management of 21 substation and transmission line design and works supervision studies

### Ethiopia

HVDC / AC interconnection between Egypt, Sudan and Ethiopia (one +/- 600 kV HVDC line, one 500 kV HVAC line, two 2,150 MW converter stations / Control centre feasibility study)

### Gabon

Inspection of 230 km of EHV overhead lines

### Kenya

Detailed study (call for tender), drafting of technical specifications for HV overhead transmission (400 kV, 230 km) and distribution (33 kV) lines, distribution substations (33 kV) and switchyard (400 kV) for the High Grand Falls hydroelectric power plant

### Morocco

Inspection and audit of the 220 kV Dar Bouazza substation

### Mozambique

Technical specifications and line and substation supervision (225 kV) / Control centre feasibility study

### Republic of Congo

Network performance support contract

### Reunion Island

Project management assistance for the construction of the Marquet substation

### Senegal

Design study for a national control centre

### Sudan

Static and dynamic studies for various consumption and generation scenarios as part of the connection of nine hydroelectric power plants

### WAPP

225 kV line feasibility study (Ghana-Burkina Faso-Mali)

### Zambia

Impact studies for the connection of the Kafue Gorge Lower (330 kV; 750 MW) and Kariba North (2 x 180 MW) hydroelectric power plants to the grid

## Laos

Management of the transmission aspects of the Nam Theun 2 hydroelectric power plant project. Supervision of the implementation of the technical specifications and site supervision of all transmission aspects of the project, including the construction of 140 km of HV lines connecting the power plant to the 500 kV Thai and 115 kV Laotian power grids, featuring a 1.2 km crossing over the Mekong River.

### ASIA – MIDDLE EAST OCEANIA

#### Cambodia

115 kV substation and transmission line feasibility study

#### China

Audit of 220 kV substations, maintenance and operation activities and telecommunication and control command system facilities

#### India

Audit of the national control centre technical specification

#### Indonesia

Network study for a circular grid (40 km, 500 kV) around Jakarta, technical feasibility study, potential for developing smart grids

#### Lebanon

Transmission grid master plan / Drafting of tender documents for the construction of transmission lines and substations (63 and 225 kV)

#### Nepal

Planning study for the implementation of the master plan

#### New Caledonia

Technical support and HV line maintenance

#### Oman

Network study for the Oman - United Arab Emirates interconnection

#### Papua New Guinea

Feasibility study for a 2,200 km HVDC link for the Purari project

#### Qatar

Study and supervision for the DMS control centre

#### Thailand

Supervision and construction of the 230 kV underground cable between Ladprao and Vibhavadi

#### United Arab Emirates

400 kV Mamzar-Dubai underground lines (11.5 and 4.5 km ventilated tunnels) / BAB project in Abu Dhabi (400 kV overhead line and construction of two 400 / 225 / 110 kV substations) / Emirates interconnection, from feasibility study to supervision / Supervision of the Baraka 2 nuclear power plant switchyard

#### Vietnam

Support for connection of the 500 kV, 715 MW Phu My combined cycle gas turbine (CCGT) power plant / Design of the distribution grid control system and installation of the SCADA system

#### Yemen

Supervision of the Marib power plant switchyard (400 kV overhead line, associated substations and 132 kV lines) / Consultancy for the national and regional load control centre



## Togo-Benin

Consultancy for interconnection works.

Construction of two 2 x 161 kV overhead lines over distances of 260 and 30 km respectively, construction of a 2 x 63 kV underground line and a 161 / 63 / 20 kV substation, extension of a 63 / 15 kV substation.

## AGILE TEAMS

Our teams, made up of 150 experts and project managers, can address your power transmission issues around the world. They combine agility and adaptability – agility based on our model with its flexible organisation and smooth information flow and adaptability supported by such practices as the dialogue we forge with local authorities, project contractors and service providers who carry out the works.

## TO SERVE CLIENTS

With more than 40 customers in 33 countries, we provide expertise for:

- State-owned companies
- Network operators and distributors
- Producers
- Administrative departments and ministries
- Funding agencies
- Industrial clients

## CERTIFICATIONS



since 2004



since 2005



# SOLUTIONS

## FAULTLESS RISK PREVENTION

We introduced a safety charter in 2013. Signed by 24 providers and partners, these guidelines enable us to support our suppliers and providers and to share best practices with them. Innovation and management thus foster risk prevention.

## INNOVATION, OUR PRIORITY

**Our active pursuit of innovation and our long-term approach support the high quality of our work. A few examples developed with the Group R&D team serve to illustrate.**

To support the integration of renewable energies in the network, we introduced the probabilistic approach. The method enables us to characterise production variability in order to reduce the uncertainties inherent in intermittent generation and to maximise the systems' renewable energy potential. This approach has been successfully

applied in designing the island networks operated by our Group. In another development, we carry out investigations to improve the performance of equipment. The research is notably focused on underwater cables, which are needed to connect offshore generation facilities and to interconnect countries and islands.



## CUSTOMISED SOLUTIONS FOR YOU

We study and master all the parameters of your project, whatever its features, in order to deliver suitable solutions. Our hands-on approach starts early in the project and includes studies, structural design, worksite supervision, handover procedures, refurbishment and optimisation. The first stage consists of acquiring an in-depth understanding of the rules governing the operation of the power system. We then perform simulations to observe energy flows and use statistical tools to balance them. We also provide a more detailed estimate

of cost effectiveness to facilitate and consolidate decision-making. The data and projections that we collect during this preparatory phase enable us to simulate the behaviour of the network for periods of up to 30 years. From contracting for your equipment and works to implementing your projects in the field and supporting your operations, our in-depth understanding of your challenges and goals enables us to work with partners and providers matching your needs and expectations to provide you with optimum support.



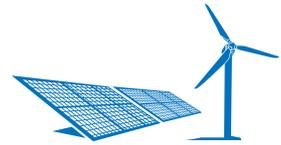
FOSSIL-FIRED



NUCLEAR



HYDROPOWER



OTHER RENEWABLES

WITH YOU  
FROM A TO Z

**NETWORK STUDIES**  
for interconnections, generating facility integration projects and master plans.

**DESIGN STUDIES**  
to determine the feasibility of a project, identify the technical and economic requirements for its success and design the installations.

**SUPPLIER TENDERING AND CONTRACTING**  
thanks to defining technical / equipment / works specifications, drafting of tender documents and conduct of contractual negotiations.

**WORKS SUPERVISION**  
from works inspection to factory acceptance, on-site testing and commissioning and warranty oversight.

**SUPPORT FOR OPERATION AND MAINTENANCE**  
including protection plans and audit, diagnostics and performance analysis assignments.



# EXPERTISE



## COMPLEMENTARY KNOW-HOW

Our experts provide consulting services, technical support and project management assistance covering all stages of your projects with respect to:

**TRANSMISSION GRIDS:** construction and reliability upgrades of **power line, cable and substation projects** in a large number of countries based on a reliable, innovative and preventive approach.

**POWER SYSTEM STUDIES:** qualification of existing infrastructure through implementation of **network studies, master plans** and static and dynamic calculations.

**LOAD CONTROL AND REMOTE MANAGEMENT:** programme management and engineering of remote management systems, design and implementation of **load control centres**.

**INTERFACE WITH TRANSMISSION SYSTEM OPERATORS:** support for power transmission system operators through mobilisation of their capabilities in the areas of **grid codes**, system services and contractual engineering.

# THE EDF GROUP, WORLD LEADER IN ELECTRICITY

## INTEGRATED ENERGY SUPPLIER

Generation and engineering  
Transmission and distribution system management  
Marketing of products and services  
Research and innovation

### Leading

Nuclear operator worldwide  
European hydropower producer  
Electricity supplier in France

**39.1** million customers worldwide

**158,467** employees worldwide

**27 locations** worldwide

**€75.6 billion** revenue

[www.edf.com](http://www.edf.com)

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