References – Power System Consulting

2019 (ongoing) Mexico	**Flexibility study of the Mexican power system** Analysis of the impact of renewable energies in Mexico on system flexibility. Assessment of operating reserve requirements. Production cost optimization for different scenarios and different spot years. Analysis of flexibility resources. Recommendations to increase flexibility.
2019 Iran	**Renewable integration in the electrical system of Iran** Support of TAVANIR (utility company) and SATBA (Energy Efficiency and Renewable Energy Agency) in assessing the impact of variable Renewable Energy on the transmission and distribution system in Iran
2019 Egypt	**Development and Implementation of Sustainable Energy Action Plans (SEAPs) –Technical Guidebooks and Capacity Building** Elaboration of technical guidelines for EGYPT ERA on how to set annual and 10 years RE and Energy Efficiency plans and how to monitor achievement and progress for each DISCO. Elaboration of technical guidelines for DISCO's on how to achieve the Sustainable Energy Action plans set by Egypt Era. Capacity building of 9 DISCO's and the Egypt ERA.
2019 Morocco	**Support of the Moroccan DSO to develop grid connection studies of RE connected to the MV grid and practical training using CYMEDIST** Development of a grid connection studies methodology for RE connected to MV, development of a guideline for grid code compliance studies, development of a manual to execute the impact studies under CYMEDIST and practical training of ONEE-BE (the Moroccan DSO) using CYMEDIST
2019 Madagascar	**Support of the Regulatory Body (ARELEC) in Madagascar to elaborate the grid code** The project is about supporting the Malagasy stakeholders including the regulatory body, the Ministry of Energy and the utility company (JIRAMA) in the definition of the technical requirements for the connection of conventional and renewable generation to the transmission and the distribution grid and to support the process of public review and approval of the grid code
2019 (ongoing) El Salvador	**Flexibility study of the power system of El Salvador** Analysis of the impact of renewable energies in El Salvador on system flexibility. Assessment of operating reserve requirements. Production cost optimization, identification of operational constraints, assessment of the level of wind and PV energy that can't be fed into the system of El Salvador (Energy not delivered).
2018 Germany	**Offshore wind farm: Risk assessment due to TSO changing the 155kV supply cables** Assess impact and risk of TSO changing 155kV supply cables, i.e. OWF to be supplied from different offshore HVDC system. Perform complete set of electrical studies (harmonics, transient studies, insulation coordination, controller stability, LVRT, protection coordination). Verification of grid code compliance.

2018 Mongolia	**RPTS ‘’Retail Power Tariff Structure in Mongolia (GIZ, 2018)** Review of the current structure of retail tariffs for electricity and heat, developing of a new tariff structure and a computer model and execution of a capacity building program
2018 Australia	**Support to update the Australian Market Rules (AEMO)** Following the black out in South Australia in September 2016, AEMO contacted M.P.E. to identify required changes to the connection conditions and to review AEMO draft update to the technical connection conditions of the Australian Market Rules. M.P.E. provided a critical review with comments and suggestions.
2017-2018 Netherlands	**Transient studies for an offshore wind farm** Execution of transient studies for a planned offshore wind farm in the Netherlands. Modelling of parts of the Dutch transmission system and execution of various types of transient studies. Insulation coordination. Preliminary design of C-type filter (size, dimensions, costs)
2018 Germany/USA	**Study about the grid connection of a 800MW offshore wind farm in the USA** Preliminary design for an offshore wind farm in the USA, including 230kV cable design, design of the onshore substation, harmonic and transient studies to identify the need of filters. Main Tasks: - Cable modelling (230kV) according to IEC600287 - Load flow and short circuit studies (reactive power, losses) - Transient studies (transformer energization) - Harmonic studies (frequency scans)
2018 Germany/Taiwan	**Study about the grid connection of an offshore wind farm in Taiwan** Preliminary design for an offshore wind farm in Taiwan, including OSS-design, 230kV cable design, design of the onshore substation, harmonic and transient studies to identify the need of filters. Main Tasks: - Cable modelling (230kV) according to IEC600287 - Design of the OSS (electrical part, layout) - Load flow and short circuit studies (reactive power, losses) - Transient studies (transformer energization) - Harmonic studies (frequency scans)

2018 (ongoing) South Africa	**Grid Integration of Renewable Generation in South Africa (Phase 3)** Supporting South African stakeholders in the grid and system integration of renewable generation (Wind, PV, CSP, biomass). Main Topics: - Grid Code Review - Preparation of a manual for grid code compliance studies - Stability study for very high penetration levels of VRE - Preparation of a nodal pricing concept - Updating the distribution operations standard - Review of the Grid Operator's distribution planning standard
2018/2019 Algeria	**Support of the regulatory body in Algeria (CREG) in the elaboration of the grid code** Review of the grid code for conventional generation and elaboration of a harmonized grid code for conventional and renewable generation connected to the transmission and distribution grid.
2017/2018 Algeria	**Support of the Opérateur du Système Electrique (OS) in Algeria with the system integration of variable renewable energies** Provision of support to the Algerian System Operator (OS) with various aspects around the grid and system integration of variable renewable energies (wind and PV) in Algeria (review of operational procedures, development of a methodology for the execution of grid impact studies).
2017/2018 Tunisia	**Flexibility Study for the Tunisian power system** Study analyzing the impact of variable renewable energies (wind and PV) on flexibility requirements of the Tunisian power system in the time frame until 2021. Analysis of the cost impact of variable renewable energies on conventional power plants.
2017/2018 Tunisia	**Grid Capacity Study for the Tunisian transmission grid** Grid capacity study analyzing the impact of variable renewable energies (wind and PV) on the Tunisian transmission grid until 2021 and identifying required transmission upgrades in the time frame between 2021 and 2026.
2017/2018 CARICOM countries	**Grid Impact Studies for three CARICOM member countries** Studies about the grid and system impact of variable renewable energies (wind and PV) on the power system of three CARICOM member countries. Identification of maximum penetration levels of wind and PV.
2017/2018 Tunisia	**Methodology for long-term planning studies** Development of a methodology for long-term grid expansion planning. Analysis of international best-practice for long-term distribution network planning. Recommendations for improving the methodology applied in Tunisia.

2017 Germany	**Development of a methodology for harmonic assessment at transmission level and integration of MSCDN** Development of a methodology for harmonics assessment at transmission level of execution of studies about the harmonic impact of MSCDNs on harmonics in the transmission grid. Design studies for two additional MSCDNs.
2017 Tunisia	**Support of the Tunisian Solar Plan** Development of a methodology for the execution of impact studies analyzing the interconnection of wind and PV farms to the Tunisian distribution and transmission grid. Execution of impact studies for selected wind and PV farms. Development of a manual for grid code compliance studies (to be executed by wind and PV farm planners and operators).
2016/2017 Nigeria	**Nigerian Energy Support Program (NESP) – Consulting services about the system integration of PV in Nigeria** Various consulting activities relating to the integration of utility-scale PV in Nigeria: - Grid Code review (connection conditions and system operations) - Review of operational procedures - Flexibility study for analyzing different dispatch concepts - System adequacy report (retrospective and outlook) - Grid studies
2012-2018 South Africa	**Grid Integration of Renewable Generation in South Africa (Grid Integration Component of the GIZ SAGEN project)** Supporting South African stakeholders in the grid and system integration of renewable generation (Wind, PV, CSP, biomass). Main Topics: - Legal framework - Grid Codes/Connection Conditions for RE - Grid Code compliance procedures - Grid connection studies - Improved system operation and efficient use of wind forecast tools - Strategic system studies - Support of municipalities in the grid integration of renewables
2016/2017 Germany	**Substation design, grid connection and studies for the grid connection of a wind farm with integrated pump storage plant** Substation design (basic design, detailed design, tendering, construction supervision), planning of the grid connection (cable sizing, design of MV substations etc.), grid code compliance studies and various consulting services relating to the grid connection of the world's first integrated wind and pumped storage power plant in Gaildorf, Germany.

2016 Nigeria	**Grid Integration Study for utility-scale PV solar generation capacity into the Nigerian transmission grid** Grid study about up to 2GW of utility-scale PV in Nigeria. Load flow studies analyzing the impact of solar generation on the 330kV and 132kV transmission grid of Nigeria.
2016 Germany	**Offshore wind farm Genaker – Optimisation of transformer configuration** Study about the optimal transformer configuration of the planed Genaker offshore wind farm. Electrical design and cost assessment including investment costs, cost of losses and cost of transformer outages.
2016 Germany	**Basic FEED-Study for the offshore substation He Dreiht** Basic FEED-Study for the OSS of the planned offshore wind farm He Dreiht. Electical and physical design of two options for the offshore substation. Cost assessment (budget level).
2016 U.K.	**Harmonic Assessment and Filter design for the East Anglian 1 offshore wind farm** Development of a methodology according to G5/5, harmonic impact assessment (including the British transmission system) and filter design for the 600MW offshore wind farm East Anglia 1 in the United Kingdom
2016 U.K.	**Grid Code Compliance Support for the East Anglia One Offshore Wind Farm** Support of Iberdrola in the execution of grid code compliance studies. Execution of insulation coordination studies (OSS, HVAC cable connection and collector grid) and harmonic performance studies.
2016 Germany	**Grid Code Compliance Support for the Wikinger Offshore Wind Farm** Support of Iberdrola with the Grid Code Compliance procedure of the Wikinger offshore wind farm in Germany.
2016 Germany	**Insulation Coordination for the GODE-1 offshore wind farm** Insulation coordination studies for the GODE-1 offshore wind farm, including 150kV OSS and cable collector network.
2016 Spain	**Grid Code Compliance support for the East Anglia One Offshore Wind Farm (U.K.)** Support of Iberdrola in the execution of grid code compliance studies. Execution of insulation coordination studies. Design of a 220kV filter, including component rating.
2016 Netherlands	**Filter design for the 600MW Offshore Wind Farm Gemini** Design of a 400kV filter for harmonic compliance of the offshore wind farm Germini with TenneT's requirements.

2016 Spain	**Wikinger Offshore Wind Farm – O&M Grid Code Compliance Review** Reviewing grid code compliance aspects for the Wikinger Offshore Wind Farm located in the Baltic Sea of Germany. Definition of a grid code compliance process.
2016 El Salvador	**Study about the impact of variable renewable generators on spinning reserve requirements of the power system of El Salvador** System impact study for analyzing the impact of variable renewable generation on spinning reserve requirements and other flexibility requirements of the power system of El Salvador
2015 Netherlands	**Offshore Wind Farm Gemini – Design verification and grid code compliance studies** Design verification and grid code compliance studies for the 600MW offshore wind farm Gemini in the Netherland. The grid connection of the Gemini offshore wind farm is realized by two 220kV submarine cables having a length of around 105km. Main Tasks: - Review of design and grid code compliance studies (insulation co-ordination, harmonics, low voltage ride through, reactive power capability etc.) - Harmonic studies - General advice to the project developer
2015 Pakistan	**Study to Determine the Limit of Integrating Intermittent Renewable Resources (wind and solar) onto Pakistan's National Grid** Grid and system integration study relating to the integration of variable renewables (wind and PV) in the time frame between 2015 and 2022. Main Taks: - Steady state studies (load flow, short circuit, contingency analysis) - Identification of required grid reinforcements - Stability studies (transient, oscillatory, frequency, voltage stability) - Flexibility studies (impact on spinning reserve requirements) - Economic assessment
2015 Honduras	**Facts Finding Mission about the Grid Integration of Variable Renewable Energies in Honduras** Identification of issues and challenges related to the increased use of variable renewable energies in Honduras. Main Tasks: - On-site meetings with network operators - Data collection - Workshops with various stakeholders

2014 Ghana	**Advisory to the Implementation of Technical Grid Integration Guidelines to the Low, Medium and High Voltage Grid in Ghana** Consultancy assignment related to the definition of grid codes and interconnection rules for variable renewable generators to HV, MV and LV grids. Main Tasks: - Elaboration of a Draft Grid Code for variable Renewable Generation with connection to HV and MV levels - Elaboration of interconnection rules for the grid connection of solar rooftop systems
2014 Tunisia	**Grid Integration of variable renewable generation in Tunisia** Consultancy assignment related to the grid integration of large scale and medium scale wind and PV farms in Tunisia. Main Tasks: - Review of the Tunisian Grid Codes (Transmission) and Distribution Codes - Proposed changes and updates of the relevant codes
2014 Namibia	**Assessment of technical and non-technical losses in the transmission system of Namibia** Developing a methodology for calculating losses at transmission and distribution levels in the power system of Namibia using power system models (loss forecast) and historical data (historical loss assessment).
2014 Nigeria	**Grid Integration of variable renewable generation in Nigeria** Consultancy assignment related to the grid integration of renewable generation in Nigeria. Main Tasks: - Review of the Nigerian Grid Code (Transmission) and Distribution Code - Inclusion of specific clauses applicable to variable renewable generation into the Nigerian Codes.
2014 Vietnam	**Vietnam Wind Grid Integration Studies** Studies analyzing the grid integration of wind generation in several Vietnamese provinces and definition of a grid code for wind generation in Vietnam. Main Tasks: - Load flow and short circuit studies - Stability studies - Grid code definition
2013-2015 South-East Asia	**Grid Integration of Renewable Generation in South-East Asian Countries** - Review of Grid Connection Conditions for Variable Renewable Energies in South-East Asian Countries (Malaysia, Thailand, Vietnam) - Presentation of Workshops about the Grid Integration of VRE.

2013 Ghana	**Grid Integration of Renewable Generation in Ghana** Consultancy assignment related to the grid integration of small and large scale renewable generation in Ghana Main Tasks: - Elaboration of interconnection rules for the grid connection small scale embedded generators in Ghana (e.g. rooftop PV) - Workshops about the grid integration of renewable generation in Ghana (small scale and large scale)
2013 Morocco	**Grid Connection of RE systems to MV and LV networks in Morocco** Consultancy assignment related to the grid connection of embedded generators to MV and LV networks in Morocco. Main Tasks: - Review of standards applicable to the grid connection of embedded generators in Morocco - Elaboration of Draft Interconnection Rules for embedded generation in Morocco
2013 El Salvador	**Flexibility Studies for the System Integration of Renewables in El Salvador** Studies analyzing the impact of wind and PV variability on spinning reserve requirements in El Salvador Main Tasks: - Residual Load assessment - Predictability assessment - Flexibility assessment of conventional power stations
2013 Germany	**OWF Butendiek – Offshore Power Supply during Installation Phase** Analysis of the wind farm Butendiek during the installation phase. Load flow studies for sizing reactive power compensation devices Definition of a switching sequence for subsequent commissioning of cable strings and wind turbine generators.
2013 El Salvador	**Grid and System Integration Study for El Salvador** Grid Study looking at the feasibility of integrating up to 200MW of wind and PV generation into the power system of El Salvador. - Modelling of wind and PV power plants - Load flow and contingency analysis studies - Transient stability studies - Voltage and frequency stability studies
2013 Germany	**Expertise: Impact of renewable generation on protection selectivity in distribution networks** Analysis of the short circuit contribution of different RE types and assessing the impact on the selectivity of overcurrent protection schemes.

2013 Germany	**Expertise: Impact of REpower wind turbine generators on Flicker** Simulation study relating to the response of Repower wind turbine generators to background voltage flicker. - Dynamic simulation studies - Flicker evaluation - Recommendation for improved tests and measurements of wind turbine flicker
2012 Vietnam	**Grid Integration of Wind Power in Vietnam on the example of the Binh Thuan Province** Analysis of the grid impact of up to 300MW of wind generation to the 110kV and 220kV networks in the Binh Thuan Province/Vietnam Tasks and roles: - Workshops about the grid integration of renewable generation - Support and review of local grid studies
2012 Mexico	**Integrate the methodology for the determination of the capacity credit for electricity generated by renewable and cogeneration plants into the Power Generating System Expansion Planning process of CFE** Integrating models of renewable energy power plants (wind, solar) and CHP into the capacity expansion planning models of CFE (WASP and PEgYT). Tasks: - Review the current practice - Work out models for renewable energy power plants - Recommendations for further improvements