

# Strategic roadmap for Egypt's grid

Siemens PTI and EETC plan Egyptian transmission network development accommodating large generation projects

## At a glance

The Egyptian Electricity Transmission Company (EETC) is the National Egyptian Transmission System Operator. In the framework of the planned rapid expansion of the generation fleet, especially the so-called "megadeal" project adding 14.4 GW alone, Siemens PTI has been tasked to assess required network reinforcements in the transmission system up to the year 2025. In the process, knowledge transfer to EETC engineers has been achieved through several training activities.

## Initial situation and challenge

Since the first decade of this century, the Egyptian Electricity Sector has been facing problems with regards to the required generation capacity. The combined population increase and economic growth have been resulting in an electrical load that was outgrowing the capacity of the installed generation. This was especially the case during the summer months, where load shedding and voltage problems were expected.

The Management of the Electricity Sector has been working hard to tackle these problems. The first of a series of measures was the installation of about

2.6 GW of fast-track generation capacity in the time frame of 2011 to 2015.

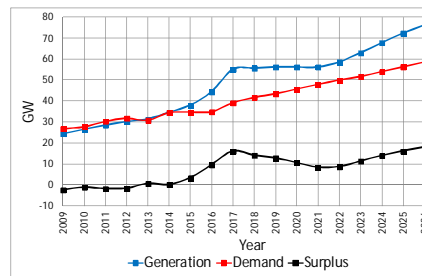


Figure 1: Egyptian electricity sector - Development of generation and demand (excluding the renewable generation development)

By the summer of 2015/2016 the Management of the Electricity Sector managed to connect a total of about 3.64 GW to the network. By far the most important generation measures were however initiated in 2015, when a contract was signed with Siemens AG for the delivery of three new power plants at Burullus, New Capital and Beni Suef (Ghayada). With their state-of-the-art and highly efficient gas-fired combined cycle technology, the three plants will deliver a total of 14.4 GW by the time of final commissioning in 2018.

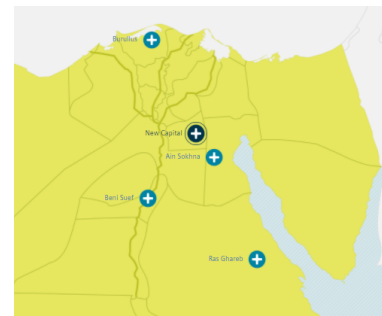


Figure 2: Location of the Burullus, New Capital and Beni Suef power plants, as well as the planned Siemens wind turbine blade factory at Ain Sokhna and the first Siemens wind project at Ras Ghareb

Looking further into the future, the Ministry of Electricity has also embarked on a program of converting a number of open-cycle gas turbines to combined-cycle power plants which should add another 1750 MW to the network. In addition to the above-mentioned conventional generation expansion, the Management of the Egyptian Electricity Sector is planning to add a further 7200 MW of wind power to the network by 2022. This is according to the strategic plan of the Egyptian Electricity Sector to increase the percentage of the renewable generation to 20 per cent of the total electricity generation by year 2022.

With its generation expansion plan described above, the Egyptian government is aiming at a sizeable surplus of power, giving rise to an important potential of power export to neighbouring countries and even Southern Europe. However, it is also clear that the dramatic increase in power flows can only be accommodated by a strong transmission system and that reinforcements to the current transmission system will be needed.

“The Masterplan project performed by Siemens PTI not only gives insight into the future development of the Egyptian Transmission Grid, but also supports EETC engineers in their planning tasks through knowledge transfer.”

Eng. Khaled Abdelkareem H. Mohamed, EETC, Board Member for Studies and Design, Cairo-Egypt

#### The solution

In 2015, Siemens and EETC started a program of transmission system planning studies in order to assess which network concepts and reinforcements will be needed in the transmission system over the next 10 years (2015-2025). The studies focused mainly on the 500 kV and 220 kV networks and consisted of the following phases:

**Phase 1:** With the help of EETC and other Ministry of Electricity departments, Siemens engineers constructed a highly detailed and up-to-date PSS®E model of the 2015 status of the Egyptian transmission system. By doing so, a fully transparent view of the existing bottlenecks was obtained and a solid basis for further planning was obtained.

**Phase 2:** In alignment with the planning experts at EETC, a PSS®E model reflecting the expected generation and electrical load in 2025 was constructed. Based on this, it was identified where the major bottlenecks in the transmission system would occur in case no further development would be made to the 2015 status of the network. Subsequently, a network concept was developed in order to tackle all the identified bottlenecks.

**Phase 3:** Finally, a PSS®E model was created which reflects the expected generation, load and transmission network in the year 2018. The reinforcements that are proposed in this phase take into account the limited available time to tender and build the required infrastructure but are at the same time in line with the goal network structure for 2025 identified in Phase 2. Also, the dynamic performance of the 2018 system was investigated.

Furthermore the 66 kV subtransmission network was investigated for the different areas and recommendations were formulated in order to overcome bottlenecks.

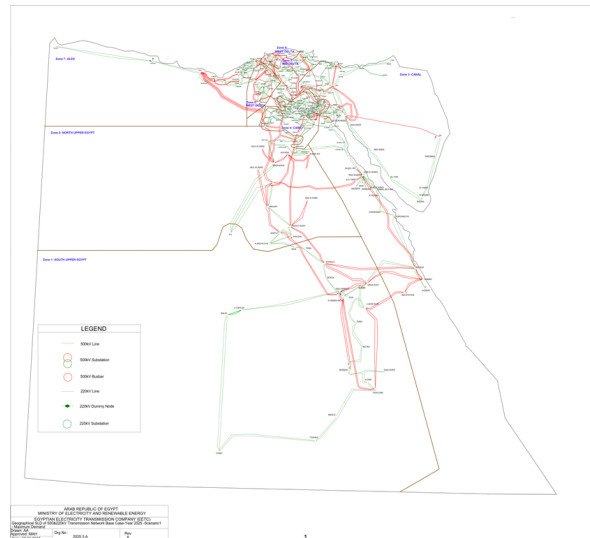


Figure 3: View of the proposed 220 kV and 500 kV transmission system configuration

On top of the abovementioned technical studies, an extensive training program was set up regarding transmission system planning practices and the handling of PSS®E for users of different experience levels. All these courses were performed by Siemens PTI experts at the premises of EETC in Cairo.

#### Key achievements

The main benefits of the strategic system planning project for the Egyptian transmission network included:

- compilation of an accurate and verified PSS®E model of the national transmission network for 2015,
- assessment of the performance of the existing system showing its specific characteristics, behavior, weak points and limitations,
- development of optimized network structures for the year 2025 as envisaged by EETC,
- identification and prioritization of critical network reinforcement projects,
- know-how transfer and staff education through workshops and customized training.

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