



# Electricity Sector

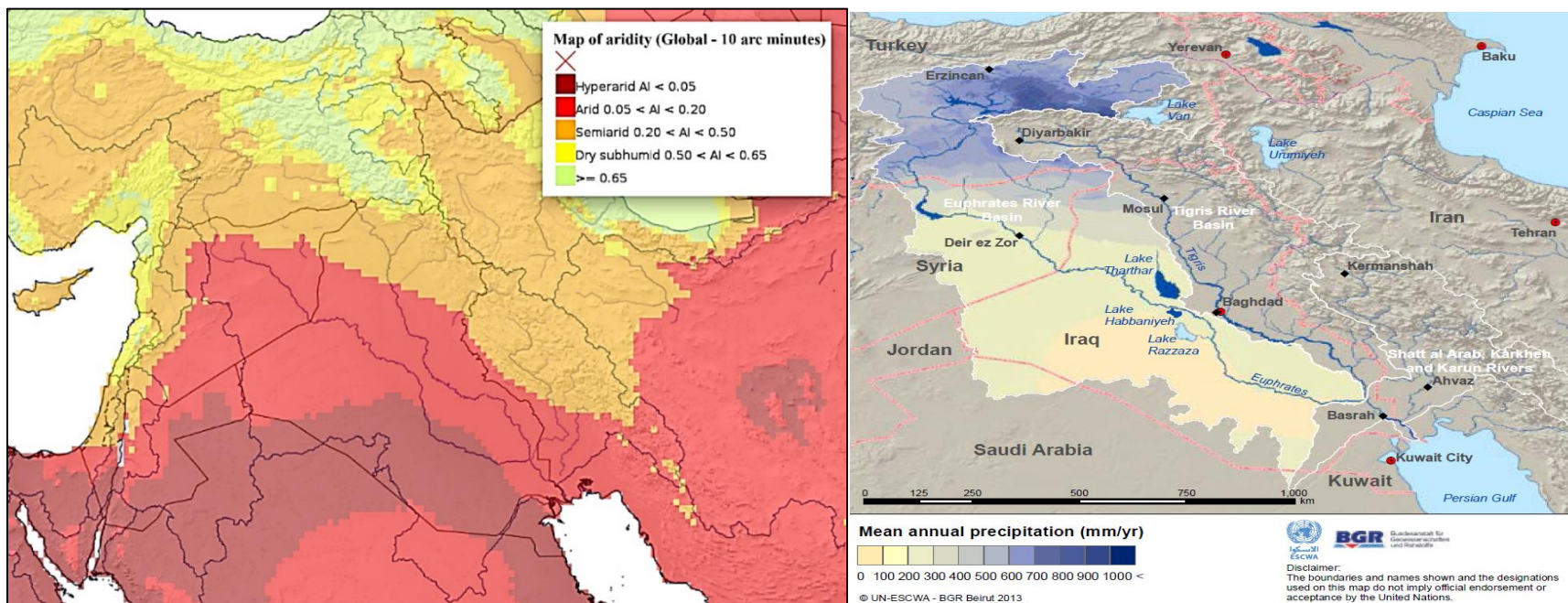
A general report showing the current situation of electrical power generation in north and east Syria.

This report clarifies the deficit in the electrical generation capabilities and presents the most appropriate strategic and tactical solutions that possible in the current situation.



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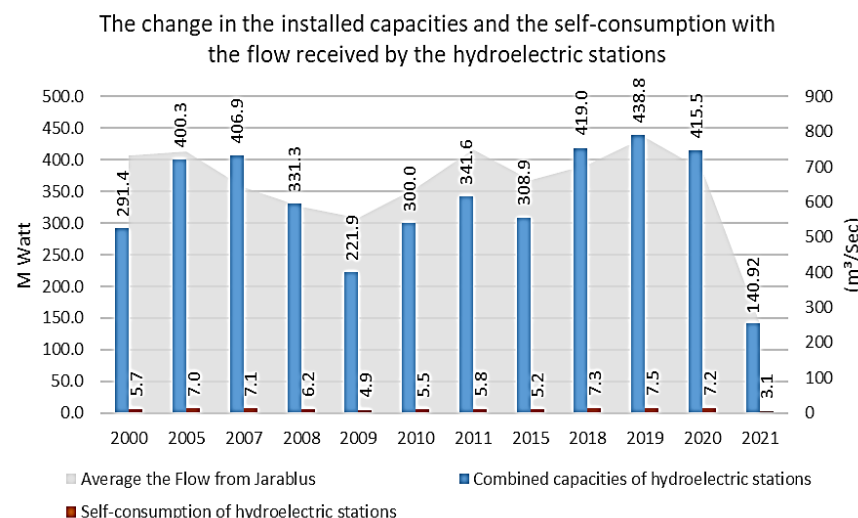
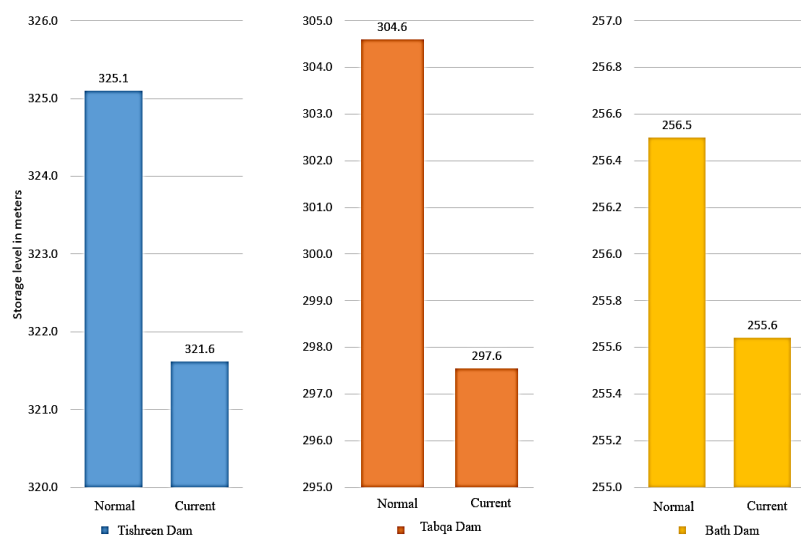
Most of the lands of the Euphrates basin are located in the arid region, in which the aridity index is less than 0.5, as shown in the map, while the southern lands of it are located in the extremely arid region, with an aridity index less than 0.2. The United Nations Environment Program defines drylands according to the aridity index, as the ratio between annual precipitation and potential evapotranspiration.



## ELECTRICITY GENETARTION:

The decrease in incoming flows from Jarablus, mean lower storage levels and volumes in the lakes of the three dams, which increases the difficulty of securing the appropriate water head and flow out to generate hydroelectric power from the turbines and reduces its yield, as well as harms all parts and components of the station, in addition to undermining the capabilities of the soil for production agricultural, and heralds a human catastrophe whose features are beginning to appear. So, the decrease in incoming flows and storage levels in the three lakes caused the Euphrates Dam to lose up to 4.1 billion m<sup>3</sup> of water from its lake so far, with a drop in its level of 7 meters.

The generated capacity in the three stations changes with the amount of flow received from Turkey. Over the previous years, it is noted that the incoming flow decreased and thus the generated capacity, as shown in graph, where the generated capacity increased in 2004 after the operation of the Tishreen station, and decreased sharply in 2021 After the growth of the Turkish GAP project, which by its completion will consume the flow of the Euphrates River by more than 50%, it is worth noting that there is a loss of data from 2012 to 2014 due to ISIS control of the dams.



In addition to the three hydroelectric dams, the electrical power generation system in NES also relies on three thermal power stations that consume natural gas in large quantities and generate energy with low efficiency that does not exceed 20%, because most of the generation sets operate



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outside their design life, among the turbines there is an estimated design life of 112 thousand working hours Actual, while it has worked so far more than 224 thousand hours of work.

After 10 years of crisis, Al-Suwaydia station contains five generating sets, three of which are in service, receiving gas with a quantity of approximately 450 thousand m<sup>3</sup>/day, producing a capacity of 42 megawatts, with a low thermal efficiency of 21.5%.

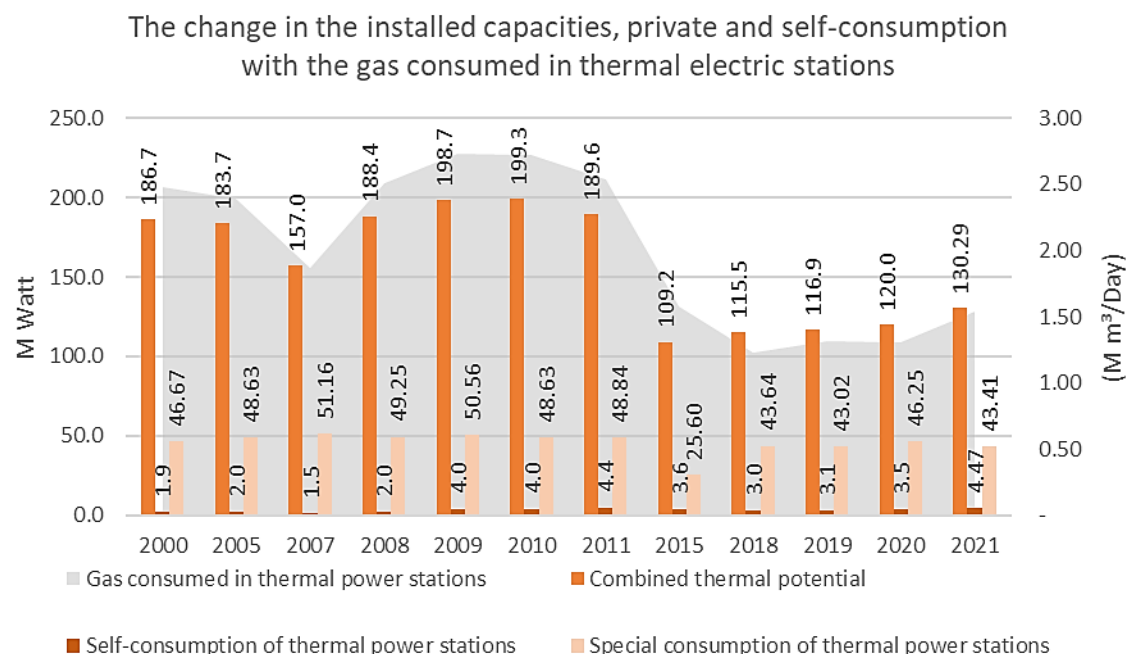
As for the Rumelan station, it contains seven generating sets, which receive gas with a quantity of approximately 1224 thousand m<sup>3</sup> / day, producing a capacity of up to 86 megawatts and a low thermal efficiency of 14.9% as it is now operating outside its design life by more than 11 to 21 years of work Actual, as it consumes up to half of its generation , by private and self-consumption, at a value of 44 megawatts, and the rest is connected with the transformers of the geographically nearby residential communities (Mabadah, Tel Kojer, Malikiyah, Qahtaniyah, East Qamishlo, and others).

The Jbessa plant, consisting of 3 turbines with a nominal design capacity of 11 \* 3 megawatts and a thermal efficiency of 30%, was established with the expertise of the Autonomous Administration and its technical cadres in 2020, as suitable quantities of free gas were available, amounting to 960 thousand m<sup>3</sup> / day, this station suffers from several design problems because it was not supplied integrated with its complements. The exhaust and cooling units were locally manufactured and installed with the expertise of technical management cadres and their modest capabilities. Before that, the station produced 5.8 megawatts, but after supplementing it with the previous two units, it produced up to 23.8 megawatts of capacity. electric.



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While the production of thermal energy from ordinary gas turbines before the crisis reached a capacity of 190 megawatts, it is currently not capable of producing no more than 130 megawatts combined with the new Jbessa plant.

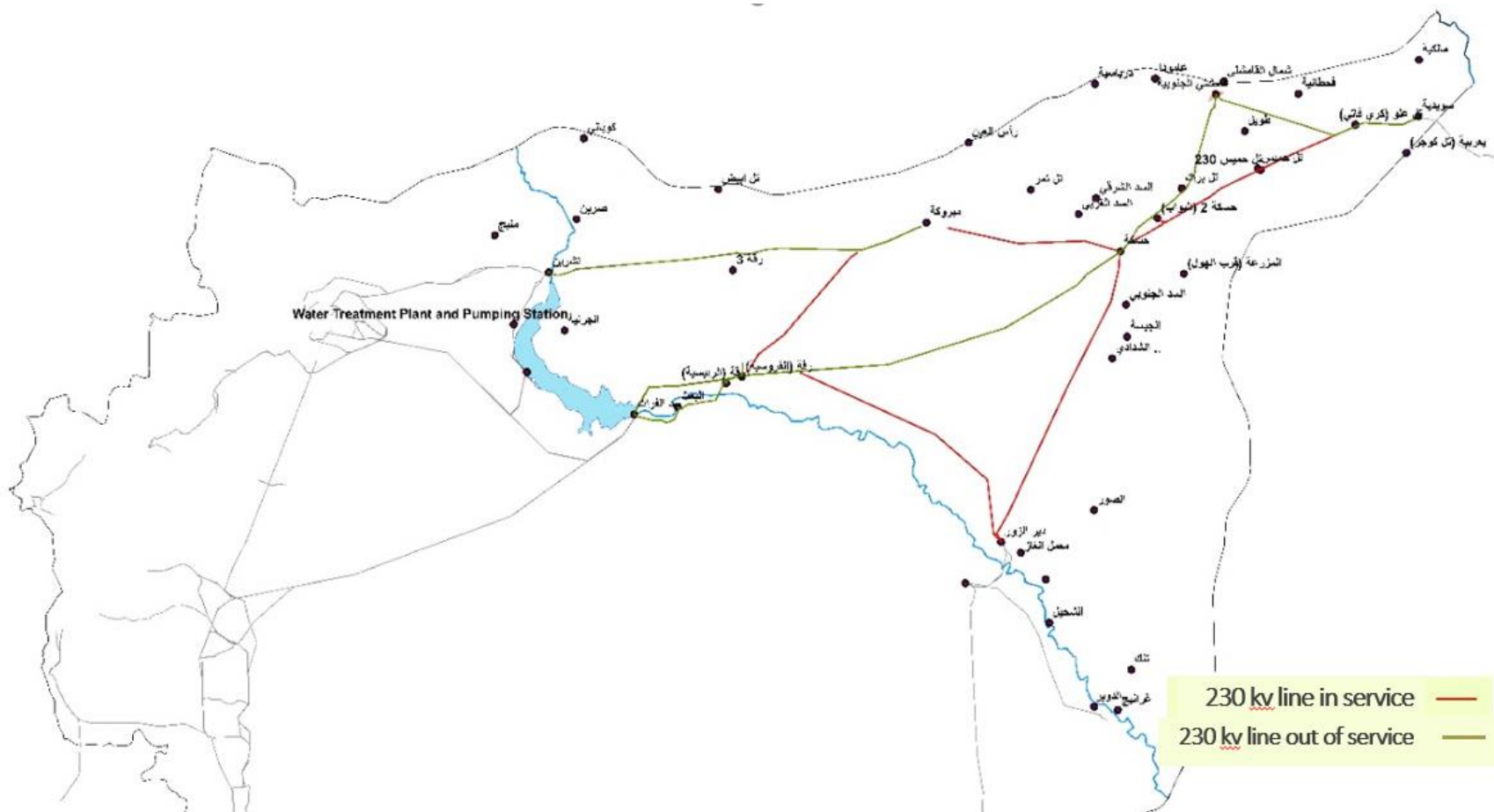


The decline in the water supply led, in general, to a decline in the performance of hydroelectric stations. As for the thermal power stations, their turbines have expired design life and benefit from only 20% of the heat content of the gas supplied to them at best, and these are the two main reasons for the decline in the performance of generating sets in the electrical power system of North and East Syria.

**ELECTRICITY TRANSMISSION:**

The transmission system in Syria consists of 400KV lines, 230KV lines, 400/230KV substations, and 230/66KV substations. Electric power is delivered at 66KV voltage for distribution. Distribution of 66KV lines, 20KV lines, 0.4KV lines, 66/20KV substations and 0.4/20KV transmission centers, to eventually reach the average consumer with tension. 220V, the electric power system in the northern and eastern regions of Syria operates according to the same system, but the 400KV lines, which were to be built, were not implemented due to the conditions of the war.





As the previous lines go out of service, the network loses its ring design and makes it along a line, making it impossible to carry out maintenance work without cutting off the current.

In addition to the main transformer station in al-Hasakah, which was completely destroyed, forcing the concerned authorities to feed the city, depending on lines and transformers with lower tension and capacities of less than a third of the city’s needs. Therefore, the least expected power outage hours will be at best more than 16 hours per day, no matter what, the generated quantities were.



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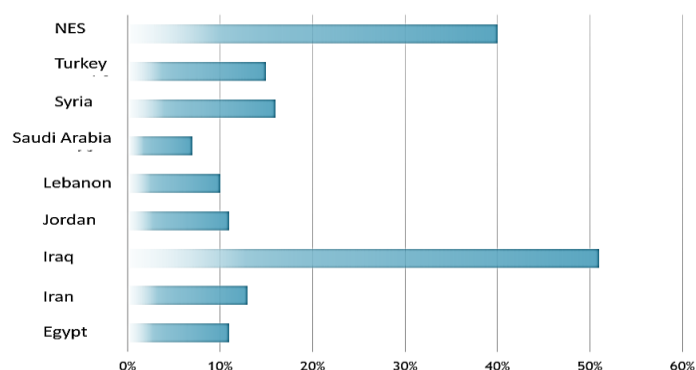
In addition to the above, the weakness and deterioration of the control systems in the stations, their obsolescence and the unavailability of transformer oils constitute another challenge for the Energy Office and its affiliated institutions, such as the Electricity Transmission Directorate, the Electric Power Distribution Corporations and the Electricity Sub-Directorates.

In 2017, after the liberation of Al-Raqqa, the Directorate of Electricity Transmission restored the 230KV line between Al-Raqqa - Al-Hasakah to service with local expertise and capabilities as a successful experiment for network restoration and maintenance work in difficult and harsh conditions.

The most pressing challenge is not only in the ability to generate electric power, but in the improvement of the transmission and distribution of power system. As efforts directed towards developing new generation capacity will be of little use without maintaining, upgrading and expanding the dilapidated electricity transmission and distribution network in the region.

Developing and upgrading the transmission and distribution network to modern and automated systems capable of meeting the needs and delivering electric power to the consumer 24 hours a day becomes a very complicated process, given that the current network is constantly operating at a minimum level of readiness with frequent electrical outages and a failure to secure Spare parts and equipment, frequent disconnection and connection as a result of rationing, in addition to continuous sabotage operations. And the deficit in emergency management because of technical and other administrative obstacles resulting from administrative and organizational divisions, and the presence of uninhabited or sparsely populated areas that are relatively unsafe. Therefore, priorities must be arranged in the rehabilitation of the transmission and distribution system, as it is a long and costly process.

According to the reports of the Energy Office in North and East Syria, the losses in distribution lines amount to 40% of the value of the loaded capacities and can be compared to the global average of 8% and neighboring countries.







The infrastructure of the areas of NES has been damaged as a result of the crisis, and there are still many violations and systematic destruction operations, as well as the deepening deficit in the generation side, forcing network operators to follow a rationing system to supply electric power to the communities, which negatively affected the transmission and distribution lines and reduced their efficiency for energy transmission due to disconnection and connection. The frequent ones that cause interruptions in the carrier cable, as well as limiting the user to certain supply hours, which made the network suffer from concentrated loads at specific hours, as the unstable network is always in a state of maximum load.

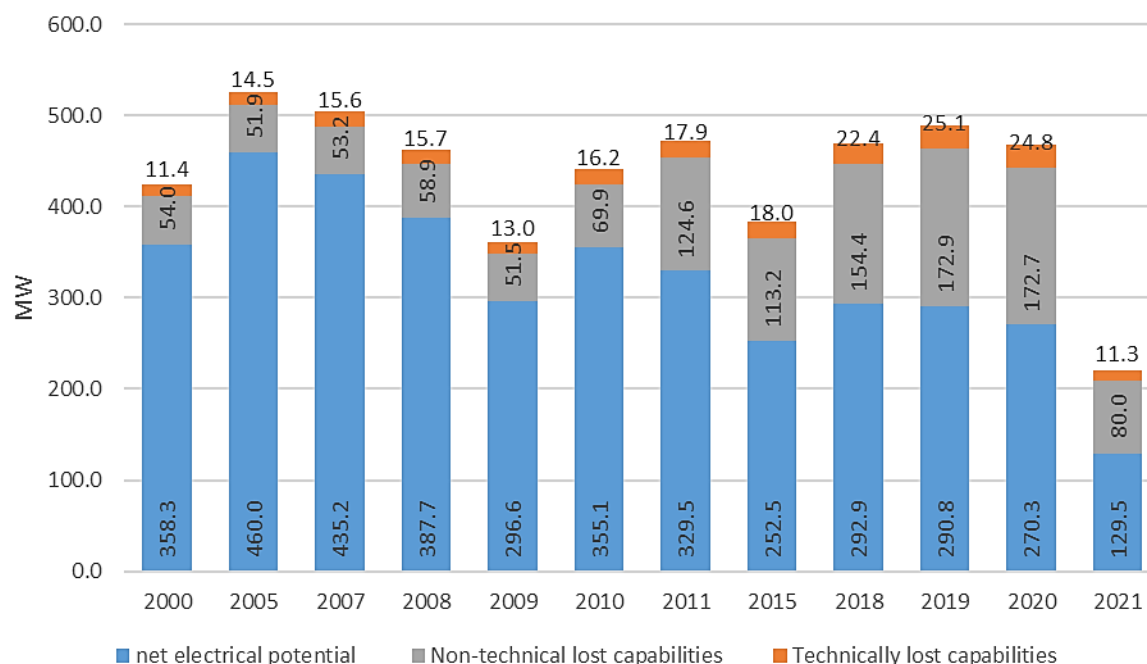
All this and more came in conjunction with the network's loss of the loop link feature, which served as a continuous load distributor and a stabilizer for the network and its loads.

As a result of the lack of a billing system, the almost free tariff, and the infringements on the distribution network, the losses are mostly non-technical.

Of the total generation of 220.8 megawatts, electric capacity from all power stations in north and east Syria, 5.1% is lost in its technical form, that is, it is on its way to the consumer, to consume an estimated 209.5 megawatts in the gatherings, of which 36.3% is also lost in a way non-technical, meaning not collected from the consumer, which in total constitutes 41.4% of the generated electricity is lost.



The total capacity feeding the public network and the lost ones in the areas of the Autonomous Administration

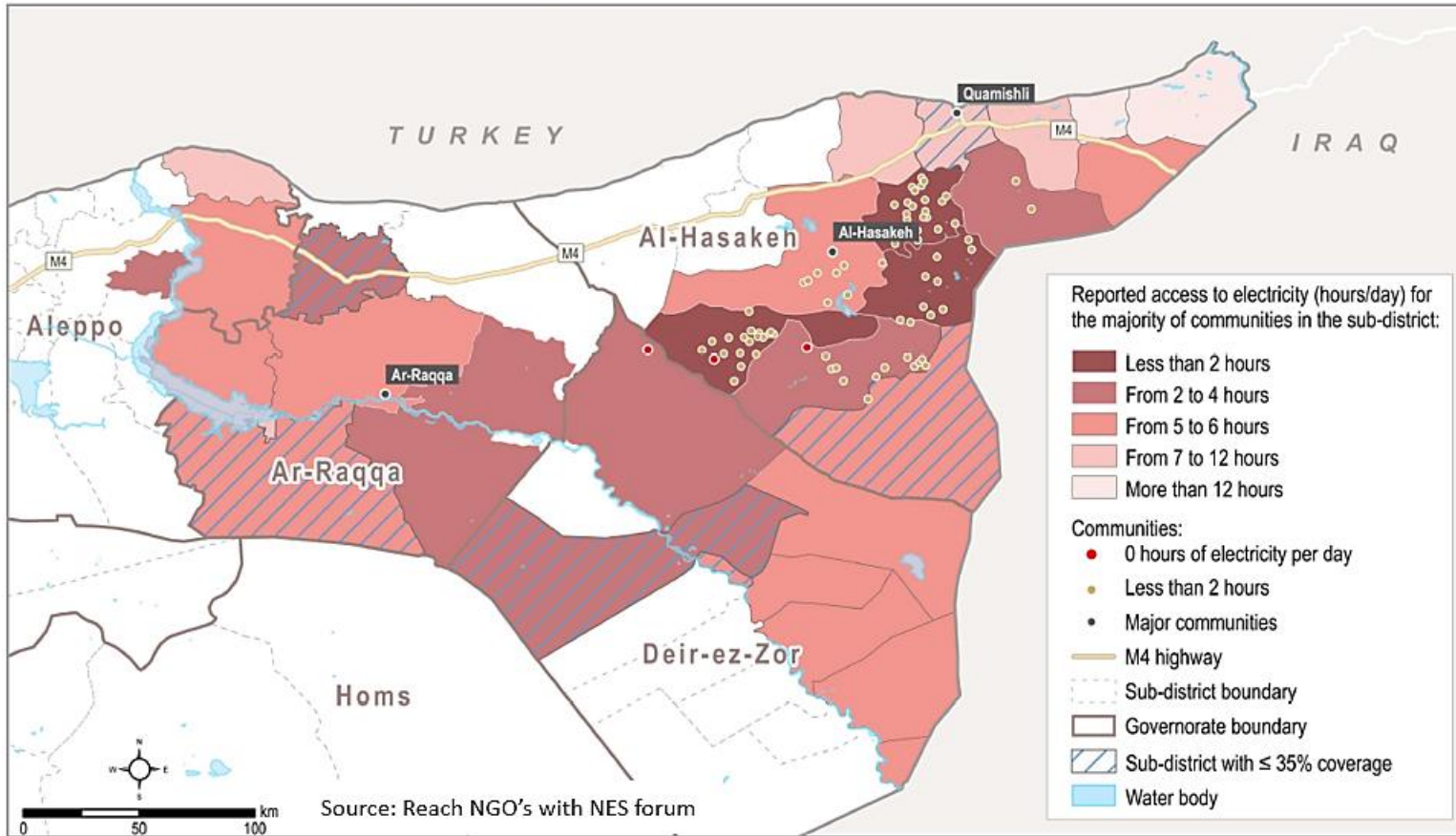


**ELECTRICITY CONSUMPTION:**

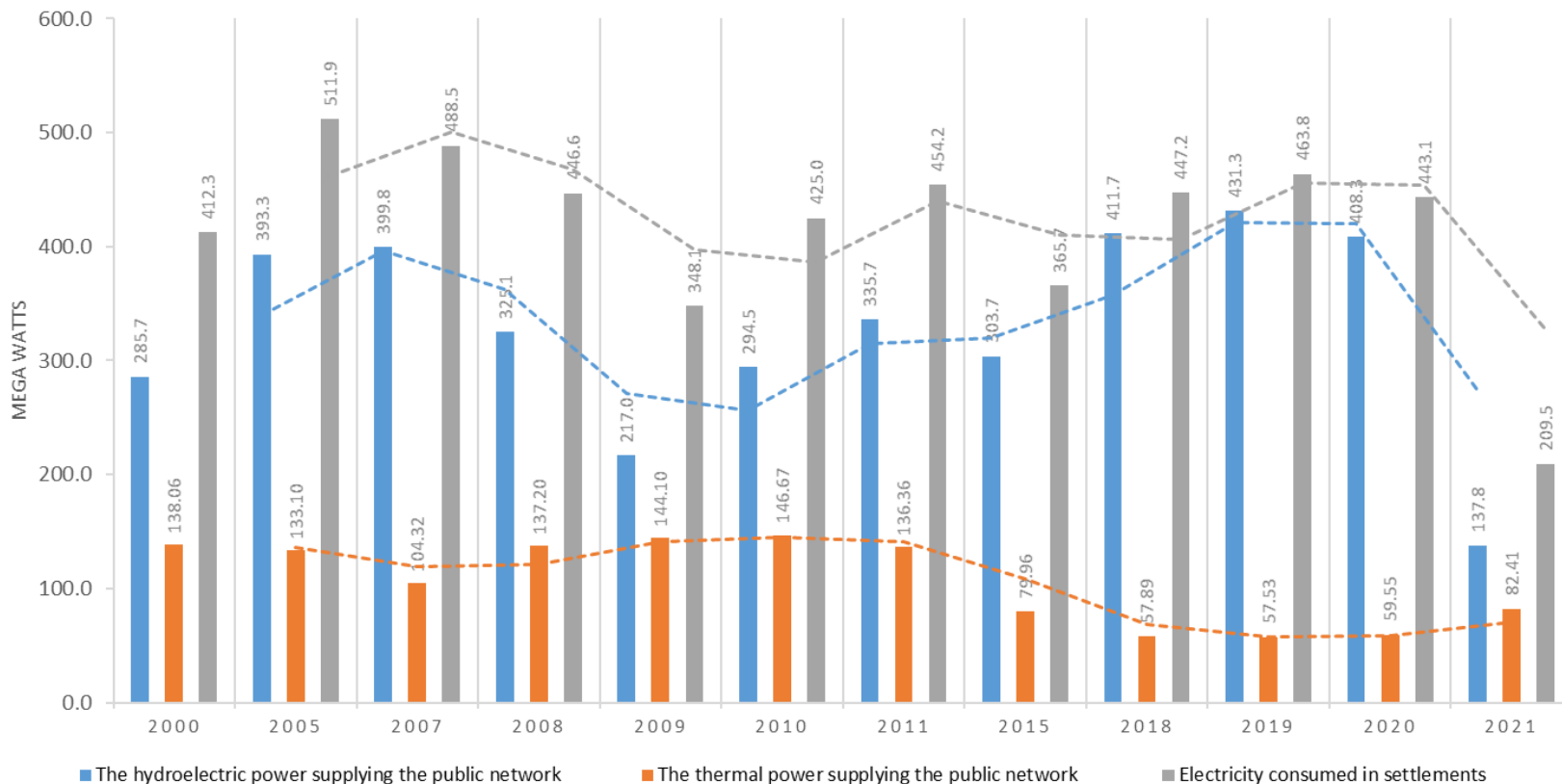
As more than 4.2 million people live in the Autonomous Administration areas, their total needs for electric power at a minimum reach 667 megawatts, of which 227.8 megawatts are currently covered, from various sources inside and outside the public network, with an estimated number of home subscribers at 279.5 One thousand subscribers, the administration has the right to collect from them up to 1.2 million dollars / month, while only collecting 82 thousand dollars, at a rate of 1000 SP / month from each subscriber, and this is because the hours of electricity supply vary, and it averages 5 hours per day.



## Access to electricity in May 2021▲



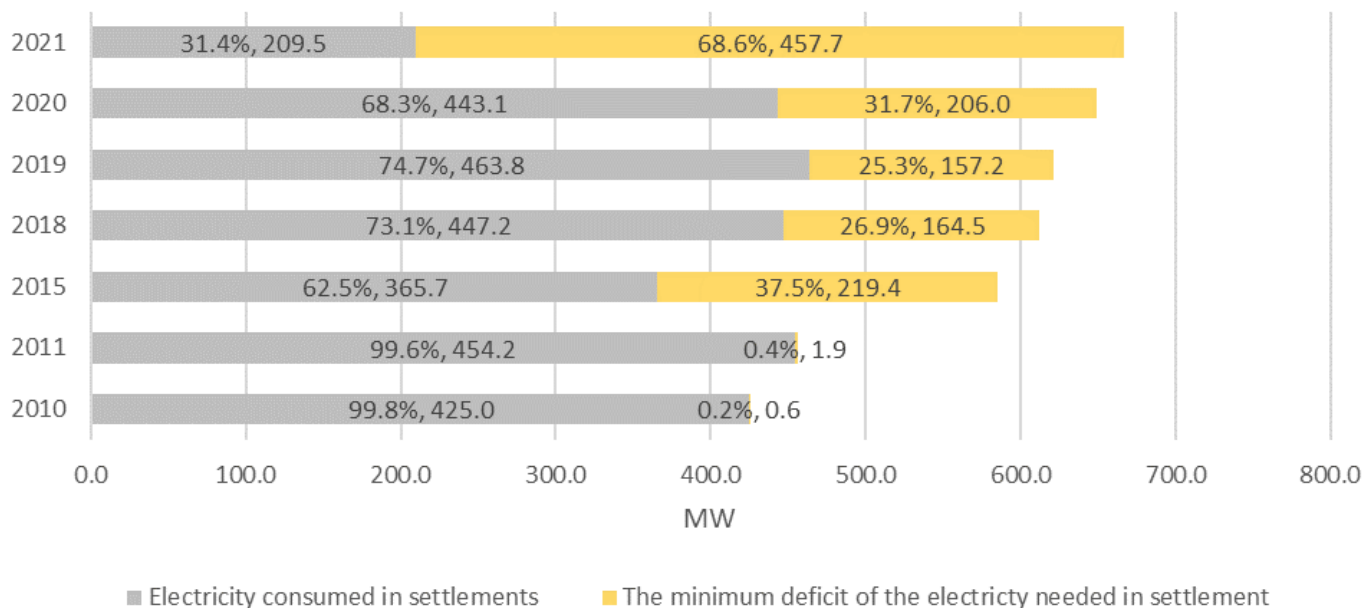
### THE CHRONOLOGY OF THE INSTALLED CAPACITIES OF THE GENERATION STATIONS IN THE AREAS OF THE AUTONOMOUS ADMINISTRATION



It is noted above that the highest consumption in the localities was in 2005, which amounted to approximately 512 megawatts, but this value did not come only from power stations in north and east Syria, but from all stations operating in the Syrian electricity system connected to the ring at the time, in addition to that The energy needs of electricity at that time were not characterized by the expansion and spread that it is witnessing today, as well as the number of the population and their economic activities were stable and limited mainly to agriculture.



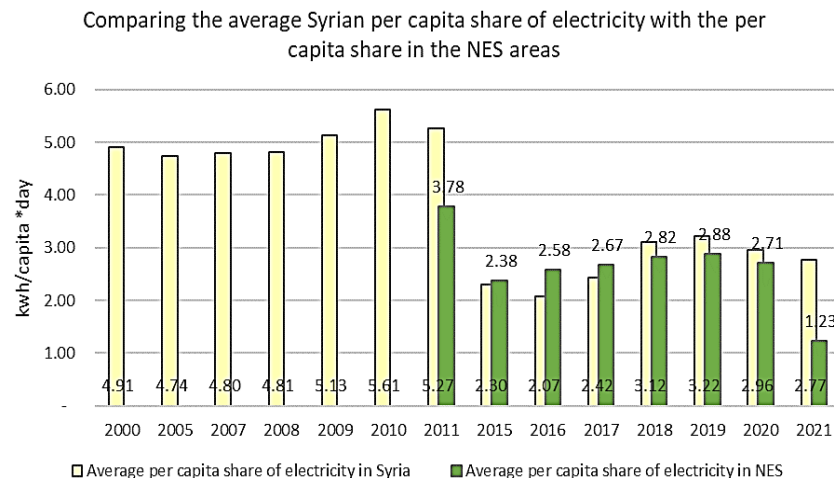
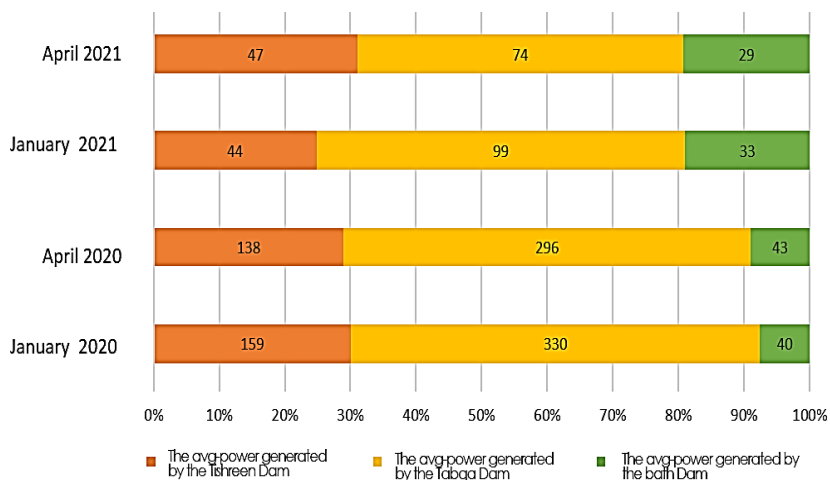
Coverage ratios and values and the deficit in the minimum need of the electrical capacities needed in the settlement within NES areas



The decline in the consumed capacity of the total available generation sources, including diesel generators, in 2021 to a value of 209 megawatts, is mainly caused by the decrease in the generation of hydroelectric dams, against the background of the water crisis and its effects on energy and the availability of the water source (the coming flow and the appropriate water head), this can be summarized The electrical crisis at the Euphrates hydroelectric station, as shown in Chart below, which was producing approximately 330 megawatts in 2020, compared to 99 megawatts in 2021, Where all hydroelectric power stations contribute up to 71% of the total generation capacity in the NES areas since 2011. Due to the current conditions, this contribution decreased to approximately 62% in 2021.



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It turns out that the suffering of the residents of the Autonomous Administration areas in particular and the population of Syria in general began with the onset of the crisis. Five years of the crisis was enough to reduce the share of the Syrian individual from 5.6 to 2.3 kWh per capita/day, while the individual in the administration areas did not receive a share of electrical energy exceeds the value 2.8 kWh per capita / day since the start of the crisis, which decreased to approximately 1.2 kWh per capita / day in 2021, and this alone if you compare it to the average global per capita share of 8.58 kWh per capita / day You will realize the extent of the disability and the degree of its depth.

**The current situation of the current energy component is characterized by limited and inefficiency in investing the available resource, and shortness and inability to cover the current loads, as it depends on two natural resources mainly, namely gas and water, which supply the public network with electric capacities of almost 210 megawatts, which do not cover the minimum energy requirement in all NES areas is estimated at 667.2 megawatts.**



**SWOT ANALYSIS (STRENGTHS, WEAKNESSES, OPPORTUNITIES AND THREATS)**

**Threats**



- The delay in investing gas as a non-renewable resource, and the continuous rise in the costs of its infrastructure.
- Completion of works at an accelerated pace to complete the projects in southeastern Anatolia, the river will lose 50% of its natural resources, and this is expected to happen in the next few years.
- The continuation of the Syrian conflict, and the state of instability for a longer period, in addition to the provisions of Caesar's Law on the regions of northern and eastern Syria.
- The continuation of forced migration, especially internally and towards the main cities, causing spatial imbalances and enormous pressure on infrastructure and facilities.

**Opportunities**



- Orientation towards investing in natural gas, to cover the deficit in base loads in combined cycle gas stations.
- Entering into serious negotiations regarding the sharing of international and common waters between the riparian parties on the Euphrates River.
- Removing the rural loads from the network in the morning, with medium and small solar farms.
- Pumping ground water using solar panels.
- Removing the loads of buildings with morning use from the network, such as educational and administrative buildings, for example.
- Illumination of road axes within urban communities using solar panels.
- Increasing the vegetation cover inside the urban settlements by pumping the treated sewage water initially with a drip network that irrigates evergreen trees.
- Preparing the damaged network and repairing it with energy efficiency projects to receive the added capacities in the network in the future.

**Weak points**



- Natural gas is not invested properly, as the thermal efficiency of thermoelectric plants does not exceed 20%, and the time limit for its availability, which begins after about 35 years.
- The decrease in the water supply of the Euphrates River, which resulted in harsh conditions for the operation of hydroelectric stations, and a small return from the installed capacities.
- Lack of legislation regulating the sector of generation, transmission and energy consumption and the lack of monitoring and measurement machines and devices.
- The revenues collected do not cover the costs of depleting the natural resource, from which energy production costs 0.058 \$/kWh and covered by a rate not exceeding 5%.
- Lack of expert manpower, and lack of vocational schools that equip technical cadres and supply them with the energy sector.
- Damage to the transmission and distribution network as a result of the destructive works and harsh operating conditions, and its loss of the advantage of the ring link.
- Not investing all gas plant products, such as sulfur, in addition to partially or completely degrading and destroying some of them.

**strength point**



- Availability of natural gas with adequate heat content and quantities to cover the base deficit.
- The hydroelectric potential installed in the dams is large.
- Syria falls within the sun belt region and the availability of promising solar latency in various regions of the northeast.
- The spread of the distribution network to cover most of the regions and areas of northern and eastern Syria.
- Distinguish the workforce operating the infrastructure facilities for the electricity sector.
- The presence of natural gas processing plants, and the availability of huge quantities of it in the Conico and Omar fields
- Availability of medium potential from wind energy, in addition to biomass energy, which can be invested in specific spatially and temporarily areas

