Report of the State Comptroller of Israel | November 2024

The Ministry of Energy and Infrastructure

Development of the Electricity Sector Towards 2030

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Background

The Israeli electricity sector will face significant challenges by 2030 due to a sharp increase in electricity demand driven by climate change, including the increased frequency of extreme weather events; the need to meet various government-mandated targets, such as the transition to clean electricity production[1]; electrification of different modes of transportation (vehicles and public transport); and the construction of additional desalination facilities.

These developments require accelerated development of the electricity sector and large-scale financial investments, alongside the completion of projects from previous development plans that have not yet been implemented. Rapid development is needed in both the production and network segments and is accompanied by technological challenges that must be addressed in order to ensure reliable, high-quality, and accessible electricity supply, as required by the Electricity Sector Law, 1996.

In August 2022, Noga – Israel Independent System Operator Ltd. (Noga or the Noga Company) – prepared an integrated development plan for the electricity sector, encompassing the production and delivery segments (transmission and transformation systems), through 2030. This plan aims to address these needs. In November 2023, the Minister of Energy and Infrastructure (the Minister of Energy)[2] approved the delivery segment development plan[3] within the integrated plan. Below is a description of the structure of the electricity sector and the key players operating within it.

1 Alongside additional decisions regarding the reduction of greenhouse gas emissions, the decrease in coal usage, energy efficiency, and more.

2 The approval was granted with the consent of the Minister of Finance, in accordance with the provisions of the Electricity Sector Law.

3 This section includes the transmission and transformation system.

Description of the structure of the electricity sector

Supervision and management

Ministry of Energy
www.energy.gov.il

→

Electricity Authority

→

NOGA
Israel Independent System Operator

Ministry of Energy and Infrastructure

Policy formation, development plan approval

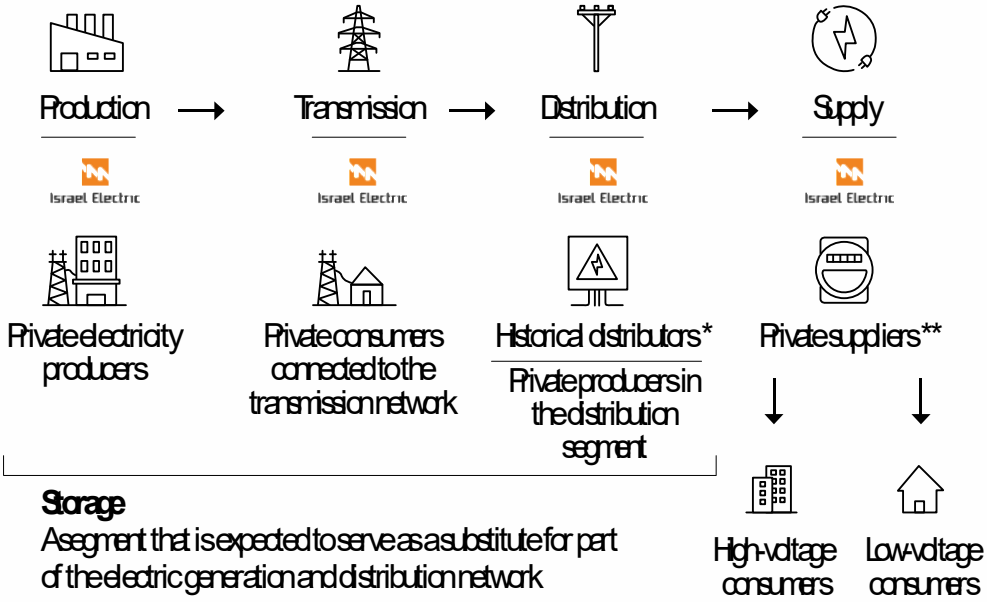
The Electricity Authority

Implementation of policy, regulation, setting tariffs and standards, issuance of licenses

Noga – Israel Independent System Operator Ltd.

Ongoing management and operation of the electricity sector, preparation of forecasts and development plans

Power supply



Storage
A segment that is expected to serve as a substitute for part of the electric generation and distribution network

Prepared by the State Comptroller's Office.

Key Figures

NIS 0.76–2.4 billion

The annual damage estimate calculated by the State Comptroller's Office, based on Noga's estimates for unmet electricity demand in 2027 and 2028, respectively, due to insufficient development of the generation system, reflects 6.5 hours and 9.9 hours of unmet demand, respectively

Approx. 33%

The cumulative growth rate in peak electricity demand is expected to reach 19.4 GW by 2030, compared to a peak demand of 14.6 GW in 2022

9–12 years

The time required to establish a conventional power plant, starting from the initiation of the approval process in planning institutions to the operation of the plant[4]

2 billion kilowatt-hour (kWh)

The estimated shortage of electricity generated from natural gas in 2030 if the risks identified by Noga in its analysis of a potential natural gas shortage materialize

Only 12.5%

Electricity generation from renewable energy sources as a percentage of total electricity generation at the end of 2023, compared to the government target for renewable energy generation in 2030, which is set at 30%

Only 5 megawatts (MW)

The storage capacity in 2023, compared to the target of 400 MW in standalone facilities and 168 MW in PV facilities combined with storage for 2023. The storage target for 2030 is 2,300 MW

Only 8 years

The planning horizon for Israel's electricity transmission system, starting in 2023. This horizon is shorter compared to the planning horizons in developed countries reviewed in the audit, which range from 10 to 20 years

NIS 2.9 billion

The average annual investment in the years 2023–2030 (a total of NIS 25.8 billion, including NIS 4.7 billion from projects in previous plans and NIS 21.1 billion from the current development plan), which is 2.23 times higher than the average for 2018–2022. These investments are expected to result in a 33% increase in the length of network lines

4 A power plant operated on fossil fuel: natural gas as the primary fuel and diesel as a secondary fuel.

Audit Actions

From July 2023 to February 2024, the State Comptroller's Office examined the planning and development of the electricity sector, including demand forecasts, development challenges for 2030, and the development plans for the generation and transmission segments and their alignment with government targets. The audit was conducted at the Ministry of Energy, Noga – Israel Electric System Operator Ltd., the Israel Electric Corporation Ltd. (IEC), and the Electricity Authority.

Key Findings

Long-Term Planning of the Electricity Sector – planning of the electricity sector must address projected electricity consumption to ensure optimal electricity supply at the national level. Previous State Comptroller reports noted that electricity infrastructure planning in Israel is characterized by a short-term outlook, covering just a few years, and that for a prolonged period, the electricity sector has operated without a master plan. While most developed countries plan their electricity sectors over a 10–20-year horizon, planning in Israel remains shorter, currently spanning only eight years after being extended from five. This is despite Israel's unique characteristics, such as being an energy island, its population density, the disparities between peripheral areas where electricity is generated and central areas where it is consumed, and its reliance on a single dominant renewable energy source – solar energy – which underscores the importance of long-term planning and timely decision-making. Previous reports also noted that the generation segment developed without a comprehensive plan, relying instead on decisions by the system operator and the Electricity Authority, as well as specific programs formulated according to various government targets. The audit found that the Ministry of Energy has not addressed the deficiency highlighted in previous reports concerning the lack of a master plan for the electricity sector. Consequently, electricity sector planning continues to occur without a comprehensive long-term perspective.

Projected Power Supply Shortfalls – Potential delays in constructing generation units and storage facilities, which Noga's documents indicate are highly likely, could undermine the reliability of the power supply, resulting in a significant increase in the hours during which the electricity sector cannot meet full demand. Thus, the results of the simulation conducted by Noga for this scenario reflect 6.5 hours of unmet demand in 2027 and 9.9 hours in 2028 – up to 3.4 times the planned unmet hours outlined in the

development plan – potentially causing significant damage to the economy. These delays, which Noga indicates are highly likely to occur, could inflict significant economic damage on the economy, estimated at NIS 776 million in 2027 and NIS 2.44 billion in 2028[5].

- **Approval of the Development Plan –** under the Electricity Sector Law, the Minister of Energy approves development plans formulated by the system management license holder (Noga), following consultation with the Electricity Authority and with the consent of the Minister of Finance. The audit revealed that, although Noga submitted an integrated development plan covering both the delivery and generation segments, the Electricity Authority had not finalized its recommendations for all components of the plan. Instead, it recommended that the Minister of Energy approve only the development plan for the delivery segment, while its recommendation for the generation segment plan remained pending. Consequently, the Minister of Energy did not fully approve the integrated development plan within the required timeframe and prior to the plan's scheduled implementation in January 2023. The Minister only approved the development plan for the delivery segment in November 2023.

- **Delayed Decision-Making on Establishing Conventional Generation Plants Required by 2030 –** the timelines set by the Ministry of Energy for formulating and approving the planning inventory of generation facilities (July 2023) required for 2028–2029 left only five to six years for the construction of power plants. This period may be insufficient compared to the six-to-seven-year timeline needed to establish a private power plant in Israel. For example, the tender for the Shorak generation plant, with a capacity of 680–900 MW designed to meet electricity demand starting in 2028, was published only in November 2023. Additionally, approval of the plan for the Kesem generation plant, with a production capacity of 870 MW intended to address demand starting in 2029, was granted only in May 2023.

- **Shortage of Natural gas for Electricity Generation –** a discrepancy exists between the natural gas supply forecasts for the electricity sector prepared by Noga, in charge of electricity sector planning, and those prepared by the Gas Authority, in charge of gas sector planning. Noga's forecasts indicate a risk of natural gas shortages for electricity generation beginning in 2026, while the Gas Authority projects no such shortage. If the forecasted shortage materializes, the damage estimated by the State Comptroller's Office will be at least NIS 186 million in 2030. It was further found that Noga, responsible for preparing development plans for the generation segment, lacks data on the volumes of natural gas available to various electricity producers, partly because this information constitutes proprietary commercial data of private producers. The lack of such essential data (regarding the volume of natural gas available to each producer) undermines Noga's

5 The calculation is based on Noga's assumption that the installed capacity shortfall is expected to total 1,180 MW in 2027 and 2,150 MW in 2028. Assuming 6.5 and 9.9 hours of unmet electricity demand in 2027 and 2028, respectively, with a deduction for the reliability criterion of 1.8 hours (resulting in total deviations of 4.7 and 8.1 hours of unmet demand from the reliability criterion), and assuming a cost of NIS 140 per kWh not supplied.

ability to plan and manage the electricity sector optimally. This disconnect could result in production plans based on Noga's identified needs not aligning with the actual gas supply available to individual producers, thus preventing electricity generation from meeting the identified demand using natural gas.

- **Electricity Generation from Renewable Energy –** the scope of renewable energy generation in Israel has consistently fallen short of the targets set by the government. For instance, the 2020 target of 10% renewable energy generation was only achieved at the end of 2022, largely due to numerous barriers, including the inability to connect renewable energy facilities to the grid, statutory constraints, and land limitations. The share of electricity generated from renewable energy in Israel in 2022 (approximately 10%) was also significantly lower compared to the OECD average of 31.3% for the same year.

- **Energy Storage –** energy storage facilities offer numerous benefits, including enhancing the system's capacity to integrate renewable energy facilities and optimizing the use of renewable energy by utilizing it at desired times; ensuring the necessary operational flexibility of the electricity sector; maintaining the reliability and resilience of the power grid; providing rapid response capabilities, making energy storage a substitute for peaker units and reducing air pollution; addressing the intermittency of solar and wind energy (for instance, due to cloud cover or fluctuating wind speeds). In addition, energy storage allows for better utilization of generation capacity, serves as a substitute for building additional generation facilities in some cases, defers investments in the power grid, and optimally leverages grid resources. The audit revealed that although Noga indicated in its development plan from August 2022 that storage facilities with a capacity of 1,800 MW should be established by 2030, and that it is required to prepare a follow-up plan for integrating energy storage facilities into the electricity grid, Noga has yet to prepare such a plan. This includes critical analyses of the required types of storage facilities, their optimal locations, capacities, and deployment schedules. However, the Electricity Authority failed to issue regulations for storage facilities providing ancillary services within the required timeframe. Moreover, storage facilities with a capacity of 400 MW, mandated for completion by 2023, have not yet been established. In 2020, the Electricity Authority initiated competitive processes to integrate 777 MW of PV systems combined with storage. According to the development plan, 168 MW of PV systems with integrated storage were expected to be operational by 2023, with an additional 659 MW planned for 2024–2025. Yet, as of the end of 2023, only 5 MW of such systems had been established.

- **Energy Storage in Israel Compared to the World –** while countries with extensive energy storage capabilities, such as the United States (especially California, which began regulating the issue as early as 2008), China, and Germany, established targets and appropriate regulations in the previous decade, Israel only began addressing the storage issue at the start of the current decade. For example, it was only in 2022 that Noga set

targets for 2025 and 2030 within its development plan, and the Electricity Authority began issuing regulations in 2020. As a result, by the end of 2022, Israel's battery storage capacity amounted to only a few megawatts.

- **Incomplete Implementation of Previous Development Plans –** Israel Electric Corporation (IEC) has yet to complete projects from previous development plans amounting to a total of approximately NIS 4.7 billion. By the end of 2022, 27% of the projects from the 2018–2022 development plan remained unfinished and were carried over into the 2023–2030 development plan. As of December 2022, these delays included the non-completion of projects involving approximately 253 km of 400 kV transmission lines, 909 km of 161 kV lines, and 17 substations. These delays compound the significant development financing requirements for the coming years, averaging NIS 2.9 billion annually between 2023 and 2031.

- **Barriers to Implementing the Development Plan for the Transmission Segment –** over the years, statutory planning has been a significant barrier to implementing development plans and establishing the required transmission infrastructure for the electricity sector. For example, statutory planning for an extra-high-voltage transmission line takes an average of eight years and can extend to 14 years in complex areas. Legislative arrangements introduced in June 2023 have the potential to streamline the planning process and shorten timelines for infrastructure construction. However, regarding 161 kV lines, most of which were built without formal plans, realizing the potential of the June 2023 legislative arrangements will be challenging. Upgrading these lines is contingent upon the approval of a designated National Outline Plan, which, as of the audit's conclusion, had not yet been approved. Another reason for significant delays in planning upgrades to power lines is the inability to halt their operation to carry out the necessary upgrade works. This challenge stems from the refusal of Noga to grant approvals for outages, combined with underdevelopment of the network by the Israel Electric Corporation (IEC), which has created obstacles to securing such approvals.

- **Financing the Development Plan –** since 2020, the financial condition of the Israel Electric Corporation (IEC) has deteriorated, as reflected in a 26.3% increase in its financial debt and a 10.9% decrease in its operating profit. Consequently, IEC has failed to meet its financial targets. This trend is expected to continue through 2030, according to IEC's long-term financial forecast. Given IEC's worsening financial condition and its failure to meet its targets, there is a significant risk that the development plan may not be fully implemented. This risk is further amplified by historical precedent, which demonstrates that IEC has previously failed to fully execute development plans under similar conditions.

- **Low Effectiveness of Regulatory Actions in Advancing the Electricity Sector –** the actions of the Ministry of Energy, in charge of advancing the electricity sector, have proven insufficient in promoting the construction of the required electricity infrastructure at the necessary pace in the coming years. The ministry has failed to ensure that various

projects are executed as planned, within the approved scope of resources and timelines. This includes the selection of conventional power plants to be built, failure to meet renewable energy targets, and other shortcomings. As a result, the risk of failing to implement the development plan is high. Moreover, entities within the electricity sector such as the Ministry of Energy, the Electricity Authority, Noga, and the Israel Electric Corporation (IEC) often act hastily and inefficiently to address immediate crises stemming from the lack of viable solutions to critical infrastructure challenges. Hence, delayed decision-making has raised concerns about the ability to fully meet electricity demand in central Israel. Such ad hoc solutions carry the risk of managerial and economic failure, increasing the overall cost to the economy and hindering the construction of essential strategic infrastructure for Israel.

Power Supply to Central Israel – in recent years, the Ministry of Energy, the Electricity Authority, IEC, and Noga have made decisions regarding power supply solutions for central Israel, in response to the inability to fully meet demand in this region starting in 2026. In some cases, these decisions reflected changes in position and even contradicted previous decisions. They were often made belatedly, preventing adherence to the timelines required to implement the necessary solutions. The changes in decisions are, among other factors, a result of insufficient long-term planning, including the failure to develop alternatives and to address power supply needs in a timely manner following the decommissioning of the Reading power station. These shortcomings have pushed the electricity sector closer to the brink of a supply crisis in the Tel Aviv metropolitan area. Over the years, ongoing concerns have persisted about a significant risk to the reliability of power supply in the region – a risk that remains unresolved due to the challenges in implementing the development plan.

Formulation of an Integrated Development Plan for the Electricity Sector by Noga – in December 2021, Noga submitted, for the first time, an integrated development plan for the electricity sector to the Minister of Energy for approval. This plan encompasses the development of both the transmission segment and the generation system. In August 2022, the Electricity Authority published the plan for public consultation.

Key Recommendations

- The Electricity Authority should promptly formulate its recommendation regarding the development plan for the generation segment, including any necessary modifications, and submit it to the Minister of Energy. It is recommended that the Ministry of Energy ensure the completion and approval of a comprehensive long-term master plan for the energy sector. This plan should encompass all segments of the sector and include targets for the desired generation mix (renewable energy, storage, and conventional generation) as well as the required scope of development for the transmission system.

- It is recommended that the Ministry of Energy, in collaboration with the Electricity Authority, Noga, and the Ministry of Finance, work to remove the remaining barriers and take expedited steps to complete the approval processes for constructing power plants and the necessary regulations. These efforts should align with the tight timeline required for the operation of these plants. Additionally, the Ministry should accelerate the construction of the required power plants to fully meet the electricity sector's needs within the specified timeframe. The Ministry of Energy should submit a recommendation to the Minister outlining the conditions and criteria for preparing a National Infrastructure Plan for electricity generation at natural gas power plants. It should also propose steps to ensure the necessary planning reserves, aligned with the sector's needs through 2040, so that the Minister of Energy and the Minister of Finance can present these recommendations for government approval in accordance with the directives set forth in the government decision. Furthermore, it is recommended that Noga finalize the development plan for the electricity sector through 2040 and submit it for ministerial approval.

- Given the financial implications of a natural gas shortage in the electricity sector, it is recommended that the Ministry of Energy, the Natural Gas Authority, and Noga examine the discrepancies between the scenarios presented by Noga and those outlined by the Natural Gas Authority. They should determine whether the existing mechanisms within the export permits adequately address these demands to ensure that the required quantities of gas are supplied to the electricity sector. If it is found that the anticipated demands of the electricity sector are not fully met, the Ministry of Energy should take steps to secure the necessary natural gas supply. Additionally, the Ministry of Energy should ensure, as part of its natural gas export policy, that there is a balance between domestic needs and the issuance of export permits, guaranteeing that the local market's full requirements are met. This issue is of heightened importance, particularly given the risks to the regular gas supply that arose during the Swords of Iron War.

- It is recommended that the Ministry of Energy explore ways to ensure that Noga has the necessary information for planning the electricity sector. This information should include the gas needs of the entire electricity sector on an hourly basis over the long term, as well as the existing gas supply on an hourly basis while taking into consideration various factors such as the gas transmission capacity in the pipelines, the gas production capacity from

the reservoirs, and the volume of gas guaranteed to each electricity producer. This would enable Noga to identify gaps, alert relevant parties, and reflect these issues to government bodies so that they can explore ways to close these gaps.

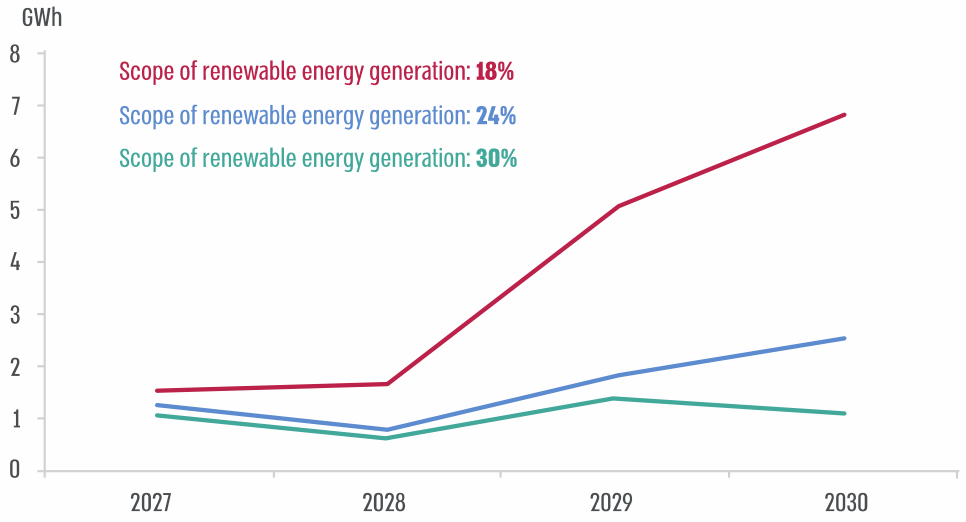
- The Ministry of Energy, in consultation with the Electricity Authority and Noga, should update the Roadmap for Renewable Energies in 2030 based on current data regarding actual renewable energy capacity, the effectiveness of measures taken, as well as remaining barriers and newly identified gaps. The updated plan should include timelines, milestones, and new steps required to achieve the targets. The Ministry of Energy should approve the plan as mandated by the provisional directive set forth under the Electricity Sector Law.

- It is recommended that, in addition to the actions already taken by Noga, it promptly prepare a follow-up plan for integrating energy storage facilities into the electricity grid and publish it for public review. This would help increase certainty among developers regarding the required locations and types of storage. The Electricity Authority should act swiftly to publish regulations for the construction of storage facilities containing capacity necessary for ancillary uses. Additionally, it is recommended that the Authority formulate regulations for the establishment of storage facilities for 2029–2030 and monitor the pace of their construction through 2030, in alignment with the overall development plan.

- Given the importance of infrastructure projects in the electricity sector, the Ministry of Energy should formulate additional measures in collaboration with relevant government entities, including the Electricity Authority, Noga, and external stakeholders such as various planning bodies, including the National Planning Administration. These measures should be developed within an emergency framework to remove remaining barriers and facilitate the advancement of these projects within reasonable timelines, ensuring that the needs of the electricity sector are not compromised. Given the significance of this issue, all parties must demonstrate a willingness to develop immediate solutions designed to address the electricity sector's development needs and ensure the proper functioning of the sector as a whole in the coming years.

- It is recommended that the Ministry of Energy, the Electricity Authority, and Noga draw lessons from the failure to make decisions within the required timelines and the resulting impact on their ability to meet development needs for the central region and beyond. They should ensure that future planning for the sector is conducted proactively, including evaluating alternatives to overcome development barriers and ensuring the timely implementation of chosen solutions. Additionally, it is recommended that the Ministry of Energy, the Electricity Authority, Noga, and the Israel Electric Corporation (IEC) monitor the implementation of the transmission alternative in all its components and ensure that the projects are completed on time in order to provide the central region with the required electricity reliably and with the necessary quality. Furthermore, it is recommended that they prepare and approve a contingency plan in advance, in the event that the projects do not progress according to the required schedule.

Unsupplied Energy in the Years 2027–2030 Under Various Scenarios, Without the Construction of Co-Generation Power Plants (NGPPs)



Source: Integrated Development Plan, August 2022.

Summary

The electricity sector is expected to face numerous challenges in the coming decade, including international trends and government decisions in areas such as green energy, electricity generation from renewable sources, energy storage, emission reductions in the transportation sector, the introduction of electric vehicles, and more. All these require accelerated development of the electricity generation and transmission segments.

The audit revealed that the electricity sector is not prepared to address these challenges, with significant gaps between the pace of decision-making and the time required for sector development. These gaps include insufficient regulatory frameworks, lack of physical infrastructure development, delayed decision-making, short-term planning, and failure to address barriers. The electricity sector is on the verge of a crisis, the consequences of which may manifest in the inability to meet electricity demand in the coming years, causing significant damage to the economy. Doubts exist as to whether the gaps can be bridged in the remaining time, particularly given the numerous barriers to the required development. All stakeholders in the electricity sector, including the Ministry of Energy, the Ministry of Finance, the Electricity Authority, Noga, and the Israel Electric Corporation (IEC), must act to remove these barriers and develop the sector to the required extent by 2030. Additionally, they should already begin examining and formulating long-term development plans in order to define policies and address future development needs effectively.

It is recommended that the Minister of Energy, who holds overall responsibility for the development of the electricity sector, ensure that decisions are made in a timely manner and that the deficiencies highlighted in this report are addressed to guarantee a reliable, available, high-quality, and efficient electricity supply, as outlined in the sector's objectives.