

A Decade of Israel's Natural Gas Revolution

SPECIAL REPORT: THE NATURAL GAS ECONOMY 2023



BDO


The Israeli Natural Gas
Trade Association

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 **IGU**
INTERNATIONAL GAS UNION
UNION INTERNATIONALE DU GAZ



Andrea Stegher | IGU Vice President and incoming President

It's a great pleasure for me to address the Israel Natural Gas Trade Association on the occasion of the release of this report summarizing ten years of unprecedented breakthroughs and success in the sector. There are few other examples of a country where, in such a short period of time, the energy shift has been more impressive, delivering both economic and environmental benefits to citizens, industry and the region at large. Gas development has been the key to transforming, in just about ten years, Israel from being almost completely dependent on the import of foreign and polluting fuels to supply its most basic energy needs in a more economic and cleaner way.

This exceptional success has been the product of developing three natural gas reservoirs – Tamar, Leviathan, and Karish – which, initially, transformed it into an independent country in terms of energy supply, and later into an important regional exporter of natural gas. This impressive achievement enabled Israel to dramatically lower pollution levels by reducing the use of coal (towards a complete cessation of its use in the next few years), and, no less importantly, enabled it to be “immune” to the global energy crisis which took place in the past two years. Thanks to the natural gas positive revolution, Israelis have also enjoyed much more favourable pricing for their electricity consumption, also substantially improving the trade balance of the State.

And gas played a crucial role in making regional ties stronger, allowing more intense and forward looking cooperation with several countries in the region and, more broadly, in an extended Mediterranean framework. Europe and the rest of the world are closely following Israeli further developments as its additional export potential could well contribute to further diversification and security of gas supplies, while not reducing the benefits for the country and its citizens. Israel's natural gas development has been a clear success story and it can deliver it on a global scale. Looking forward to promising next steps.



Amir Foster | Israeli Natural Gas Association Executive Director and International Gas Union Strategic Committee Chairman

In 2022 the world energy market underwent unprecedented upheavals with natural gas prices worldwide breaking all-time highs time and again, leading to historical increases in prices of electricity. The turmoil was experienced all over the globe, but there was one country that weathered the storm unscathed: Israel – one of the only places in the world that remained steadfast in face of the tempest. This resilience is a direct result of Israel's natural gas revolution, which has delivered unparalleled achievements for the country's economy, environment and political status.

Since the commencement of the natural gas revolution a decade ago, the Israeli economy has saved over NIS 126 billion in energy costs. The intensity of pollutants emitted by electricity production dropped by over 80%, the intensity of greenhouse gas emissions from electricity production dropped by 30% (which has made Israel a worldwide leader in the field), and Israel has become a significant source of energy security in Egypt and Jordan.

Who would have believed it? Within a decade we developed impressive natural gas production capabilities that brought Israel to such an era of energy security and independence as was only dreamt of in the the past. Within a few years, when the use of coal is terminated, domestic electricity production will be entirely Israeli. During this time, despite the impressive increase in demand for natural gas, national gas reserves have only increased, with a huge potential for further discoveries. The revolution has only just begun.

The next stage in developing Israel's gas economy entails increasing production capacity to allow maximal energy security for many decades ahead. Furthermore, improved gas exports will enable Israel to break beyond the borders of the region and become an important international energy supplier. As a result, both Israel's income and international standing will strengthen.

We are proud to publish our first Israeli Gas Economy Report: a document unlike any other seen in Israel, which constitutes a comprehensive and in-depth study of the natural gas revolution's imperceptibly powerful impact. Beginning as a far off dream, this revolution has already managed to improve all of our lives.



The Israeli Natural Gas
Trade Association

A member of



Chen Herzog | Chief Economist and BDO Partner

The discovery of natural gas significantly impacted the Israeli economy by contributing to GDP growth, reducing cost-of-living, transitioning to independence in electricity production, attenuating pollution and reinforcing geo-political ties with neighboring countries.

The world energy crisis and the Ukraine war highlight the economic advantages of energy independence. Israel's economy has demonstrated relative resilience to the global crisis thanks to the fact that 80% of electricity production this year came from domestic resources - natural gas and renewable energies.

In reality, natural gas and renewable energies in Israel are complementary sources, which together enable the attenuation of emissions, energy reliability and the reduction of electricity prices. According to government objectives, 30% of the electricity produced within the decade will be renewable, and the remaining 70% from efficient and competitive gas production will be crucial to enable the development of the Israeli economy, reduce the cost of living, and cease the use of coal.

Israel is ranked 3rd place among the OECD countries in terms of natural gas reserves per capita, and benefits from a relative advantage of using natural gas for domestic use and exports. Natural gas constitutes a considerable geopolitical advantage for Israel, catapulting economic relations with Egypt and Jordan forward.

The assurance of sufficient natural gas resources for the local market is a primary economic objective. Geological surveys and actual discoveries over the years indicate that the potential for gas along the Mediterranean shores remains huge. To realize it, it will be necessary to continue searching for and developing additional gas sources that will enable increased reserves, surpluses, competition, economic growth and increased state income. Creating a balance between export, which provides the financial anchor for additional gas exploration, and sale of gas to the local market, is vital to develop the energy economy.

Natural gas as an interim fuel has an important role in promoting a low-carbon economy and terminating the use of coal. Alongside the continued promotion of renewable energies.

Continued gas discoveries and promoting export policy, combined with retaining gas reserves required for the local market, are the cornerstones of the progression of Israel's economy, reinforcing its energy independence and geopolitical relations, and maximizing their financial potential.



Chapter I

A Decade of Israel's Natural Gas Economy



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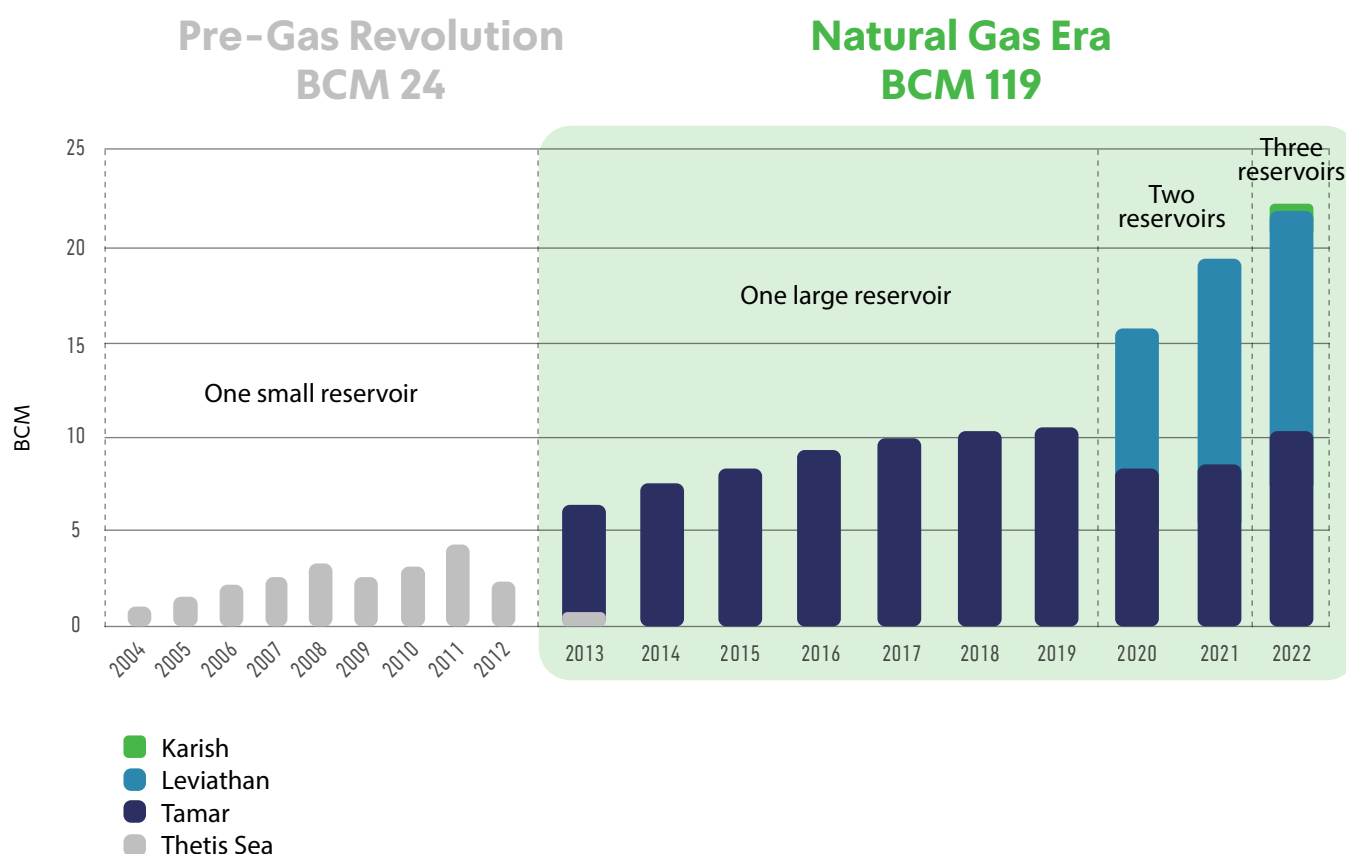
2013-2022

The natural gas revolution over the past decade

- Over the past decade local consumption of natural gas increased at **an average rate of 17% annually**
- Over the past decade the production of natural gas increased **five-fold compared to the previous decade**
- Despite the increase in gas production – current gas reserves are 40% higher than they were a decade ago**
- The increase in natural gas consumption derives mainly from a drastic reduction in the use of coal to produce electricity
- Thanks to the natural gas revolution the use of coal has plummeted by approximately 60% over the past decade**
- The absolute majority of investments come from private financing: some NIS 42 billion, 182 times higher than the amount allocated in the state budget
- Over the coming years **natural gas consumption is expected to continue to grow**, a result of the cessation of coal use and the expected growth of electricity demand
- Israel has transformed from an importer to an **exporter of natural gas**

From one small reservoir to three large reservoirs

Over the past decade the production of natural gas in Israel has increased five-fold



Source: BDO analysis of Ministry of Energy reports (royalties reports and energy market reports).
Comparison of total gas production from 2013 to 2022 to total gas production from 2004 to 2012

The scale of gas reserves has increased by 40% over the past decade

Despite the production of natural gas in Israel having multiplied five-fold over the past decade, the total quantities of gas have increased

Reservoir	Reserves 2012	Production 2013-2022	Reserve discoveries / updates	Updates reserves
Tamar	282	-88	+91	285
Leviathan	481	-29	+167	619
Karish Tanin	0	0	+102	102
Olympus	0	0	+68	68
Small reservoirs	17	-1	-3	13
Total	780	-119	+426	1,087

* Tamar and Tamar SW

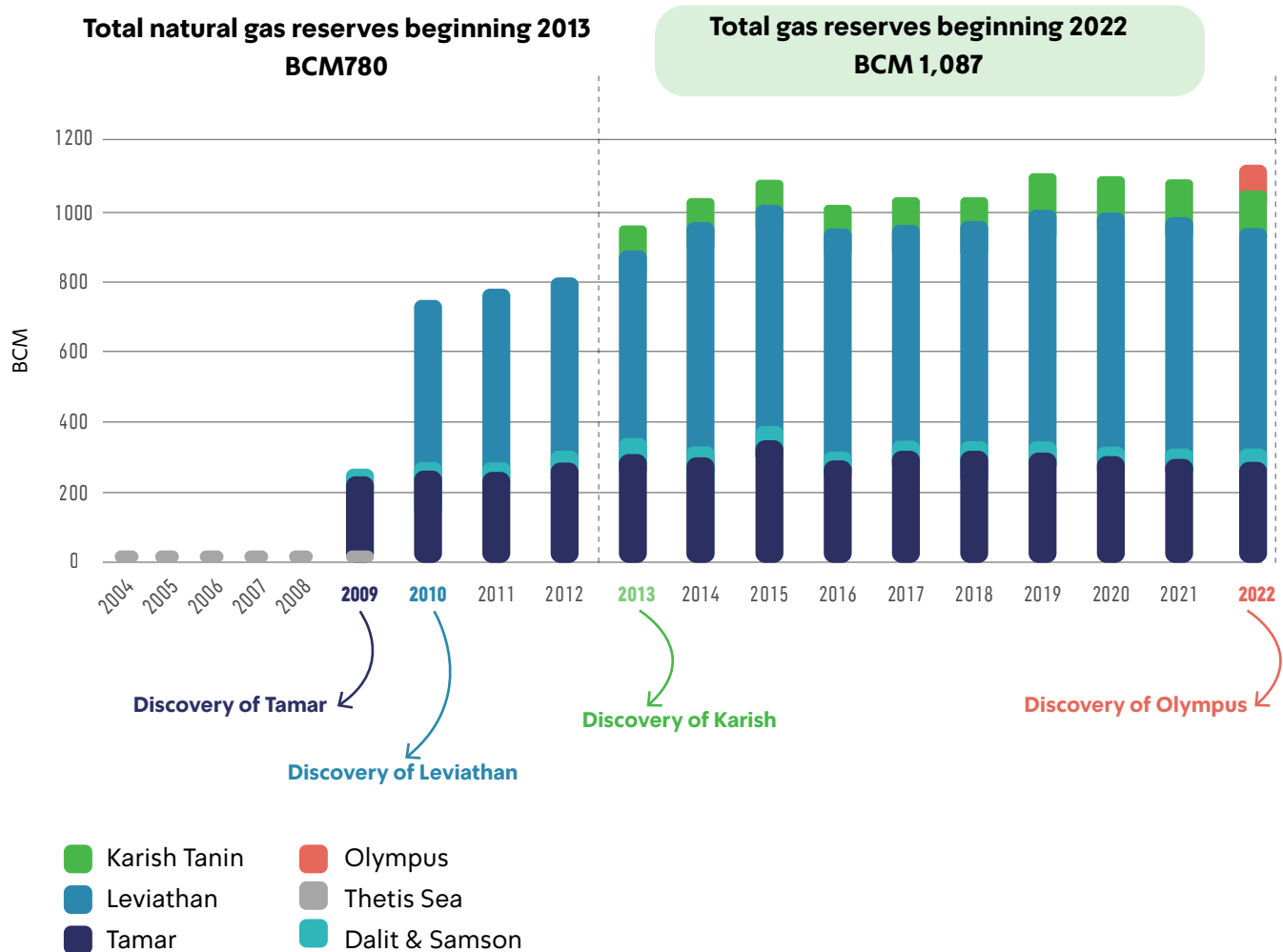
* Karish Tanin including Karish north

* Olympus-Katlan discoveries

* Thetis Sea, Dalit, Samson

Based on estimates by independent assessors on behalf of the gas companies' members, as published in their financial statements. The data includes categories 2C*, 2P and the Energean-Karish North discoveries and discoveries in the Olympus area including Non-Audited BCM 29 | BCM data

Development of Natural Gas Supply by Reservoir



Source: BDO analysis of updated reserves reports and preliminary assessments in the Olympus region, according to stock-exchange reports by the gas companies

*Reserves in 2P, 2C categories and discoveries in the Olympus region, including Non-Audited BCM 29
Additional reserves in reservoirs – according to date of including reserves in the reports

Reserves Calculation Methodology

The estimation of gas reserves in the various reservoirs is performed by independent assessors on behalf of the projects' participant companies: Netherland, Sewell & Associates Inc (NSAI) for the Tamar and Leviathan projects; DeGolyer and MacNaughton (D&M) for the Energean held projects, with emphasis on Karish-Tanin

The reports are drawn up according to accepted international rules for managing petroleum resources (SPE-PERMS) and are updated annually. In compliance with public company obligations, this data is published periodically for public perusal

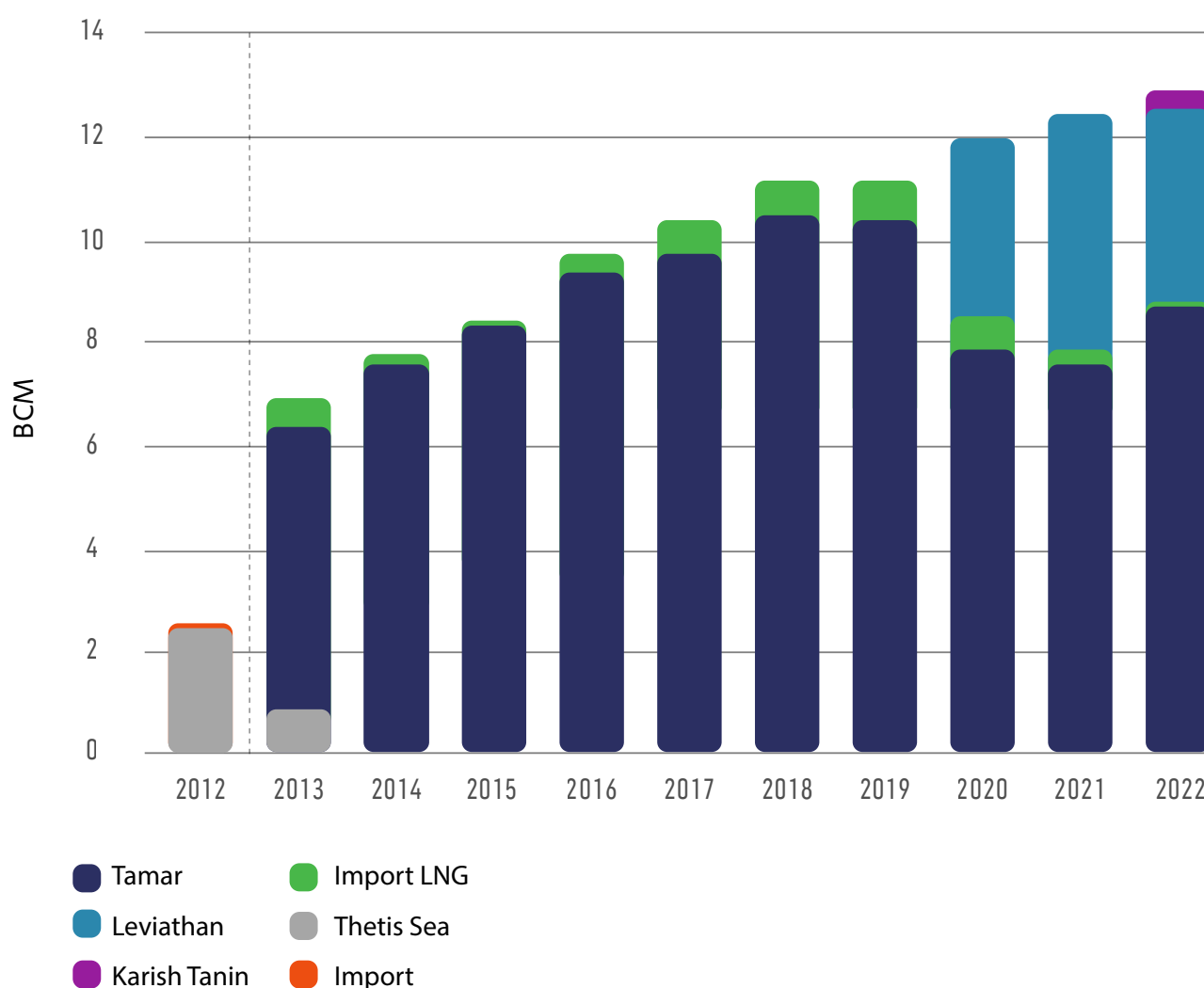
Israel's gas reserves data is based on evaluations by these entities, as published in the gas companies' financial statements and reserves reports, in accordance with directives of law and the rules of Securities Authority, and are correct as of December 31, 2022

The data includes gas reserves in Israel's various reservoirs at the 2P (Proved & Probable Reserves) level, and the 2C (Best Estimate Contingent Resources) level, as well as gas reserves of the Olympus reservoir, which were recognized by the Ministry of Energy as a discovery in 2023, based on preliminary estimates and D&M

Gas reserves are classified at 3 levels: Proved Reserves (P1), Proved + Probable Reserves (P2), Proved + Probable + Possible (3P). Contingent resources are fields at lower realization levels, the production of which depends on various conditions, such as technical and financial feasibility and accepted development plans. They are classified at 3 levels: Low Estimate Contingent Resources (C1), Best Estimate Contingent Resources (C2) High Estimate Contingent Resources (C3)

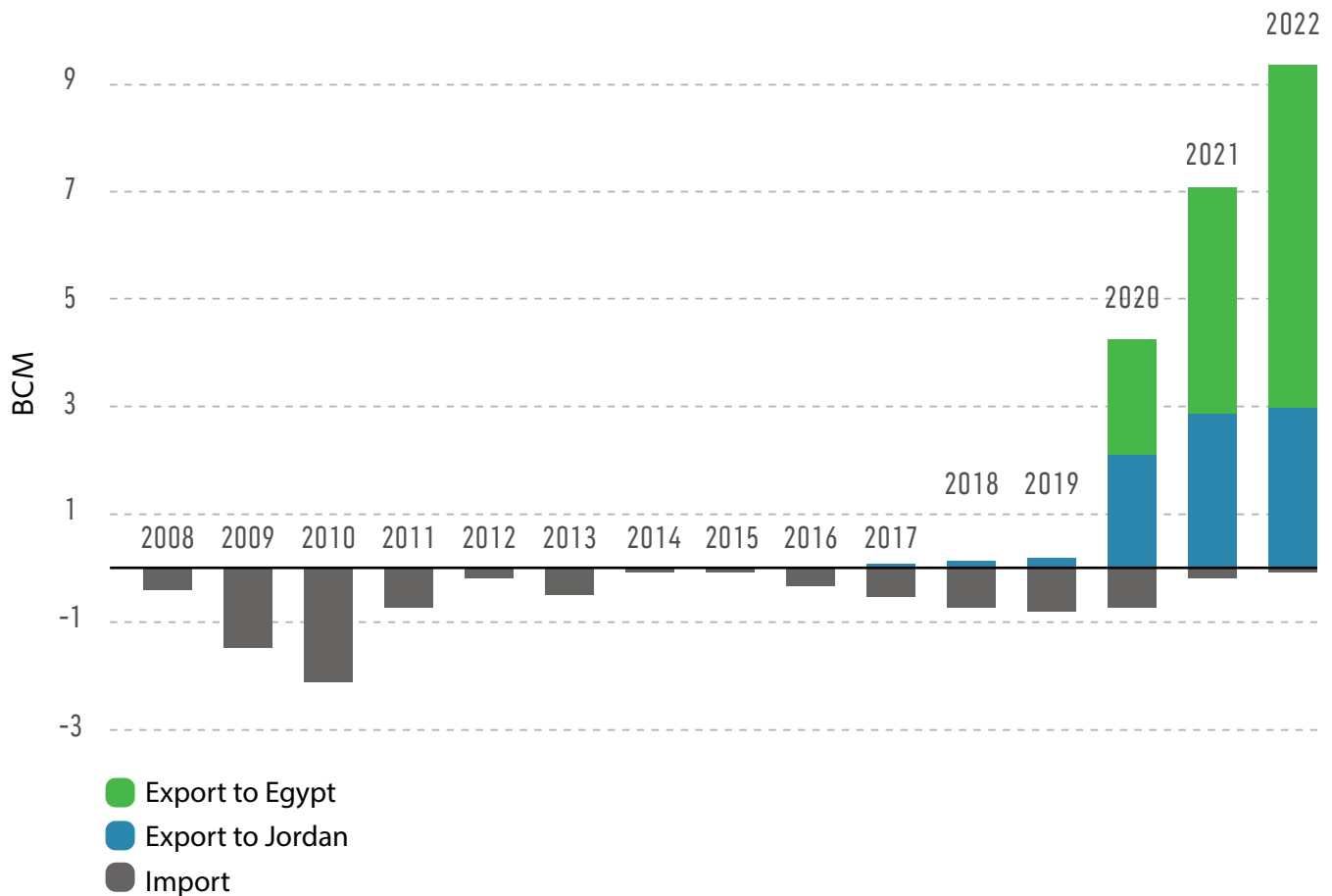
Natural gas consumption in Israel:

An average annual increase of 17% A five-fold surge in consumption (in 2022) compared to the end of the previous decade*



* The consumption of natural gas on the local market in 2022 compared to 2012
Source: BDO analysis of Ministry of Energy reports and public gas company reports

Transformation: from an importer to an exporter of natural gas

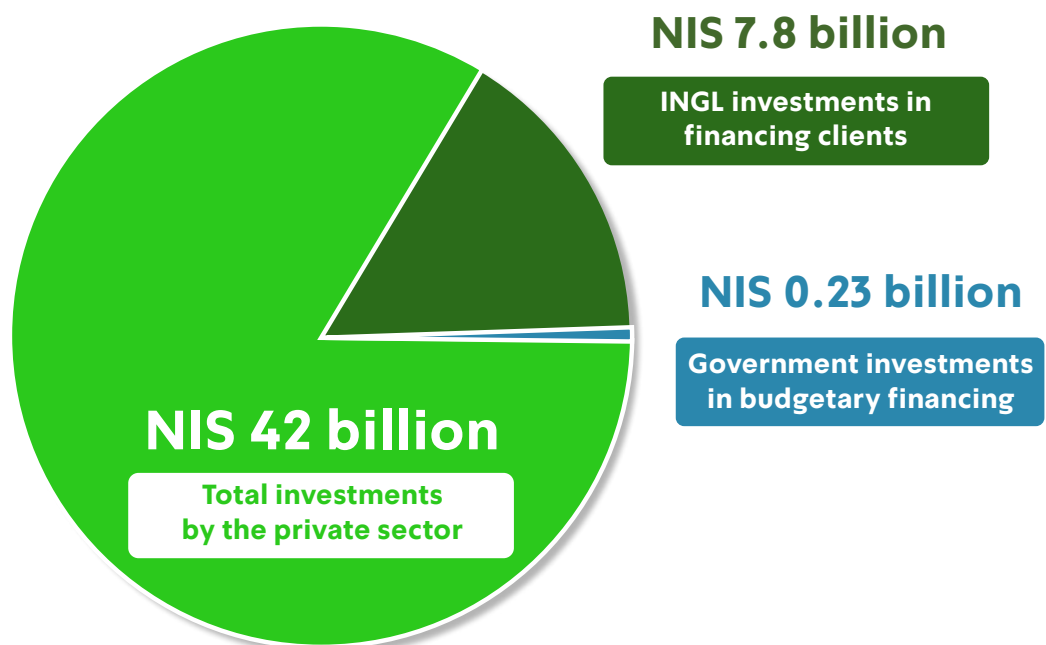


Source: BDO analysis of Ministry of Energy data, royalties reports and gas company reports.

Majority of investments in natural gas: By the private sector

Government expense: Only 0.5% of total investments

Unlike other infrastructural sectors, the government hardly finances development of the natural gas market



The government sector investments in tariff financing are based on INGL investments according to the financial statements of 2005 – 2022; government sector financing by budgetary funding for 2009 – 2021 are based on the state's budget performance reports and the November 2022 State Comptroller report. The amount reflects the realization of NIS 700 million of the amount allocated for infrastructure development; business sector investments for 2009–2021 are based on reports by companies holding rights in Leviathan, Tamar and Karish Tanin reservoirs, and do not include investments in the Olympus region reservoirs or additional investments made by the division companies (estimated by the State Comptroller in November 2022 at NIS 400–900 million).

Chapter II

The Contribution of Natural Gas to Israel's Economy



Israel's Economic Engine

The accumulated savings for Israel's economy over the past decade thanks to the use of natural gas: NIS 316 billion that constitute NIS 120.5 thousand per household.

The savings include: NIS 126 billion in energy costs and another NIS 190 billion in costs derived from air pollution and greenhouse gas savings

Approximately NIS 19 billion were paid directly to the state treasury over the past decade. By 2023 another NIS 70 billion are expected to enter the state treasury, and additional NIS 288 billion by 2050

Average gas prices in Israel over the past decade were less than half the prices in Europe (MMBTU/\$5.3 compared to MMBTU/\$10.8)

The price of natural gas in Israel is relatively stable and predictable, whereas the price in Europe fluctuates and is affected by crises

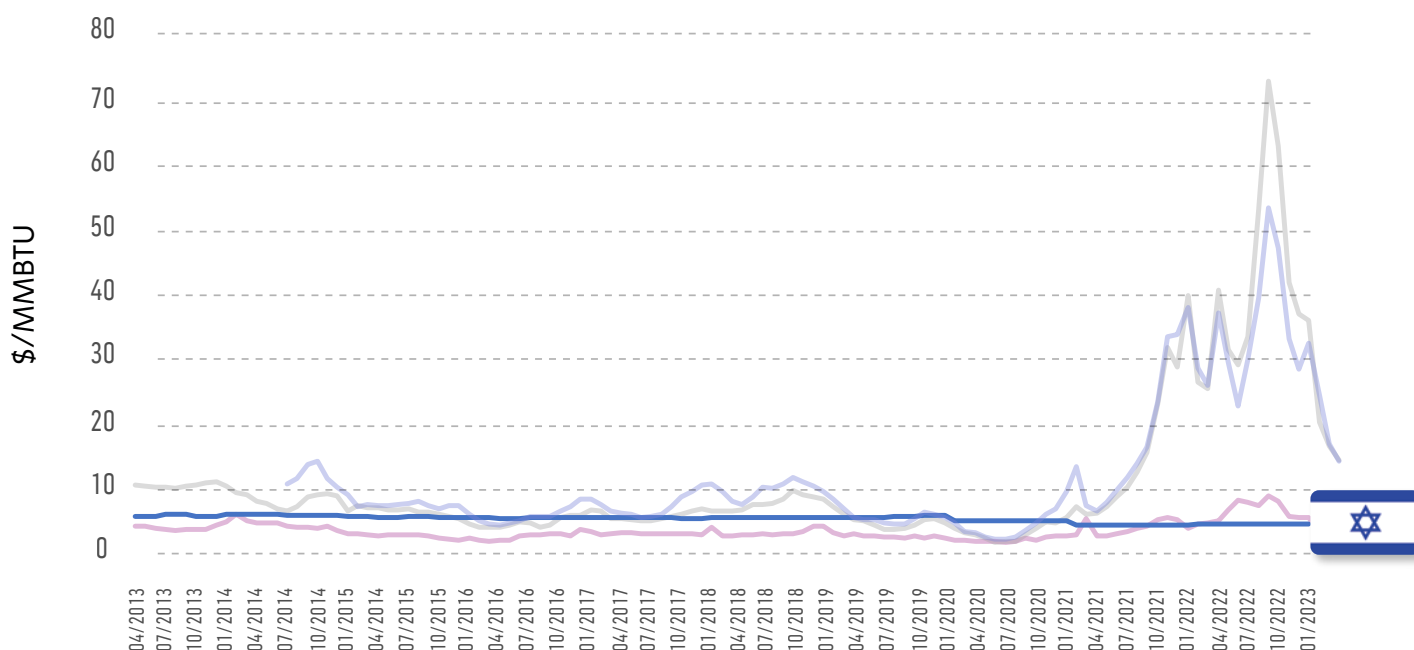
Thanks to natural gas: the price of electricity for Israeli citizens is almost half of the average price of electricity in Europe (NIS 0.57/KWh in Israel compared to NIS 1/KWh in the EU-27 countries during the second half of 2022)

Over the past decade, electricity prices for households consumers in Israel dropped by 11%, compared to an increase of 40% in Europe

The natural gas price:

In Israel stable and relatively low, in Europe fluctuating and high

Energy prices in Israel and Europe \$/MMBTU- 2013-2022



In Israel

Average price \$/MMBTU 5.3

In USA

Average price \$/MMBTU 3.4

In Europe

Average price \$/MMBTU 10.8

Liquid gas in Japan and Korea

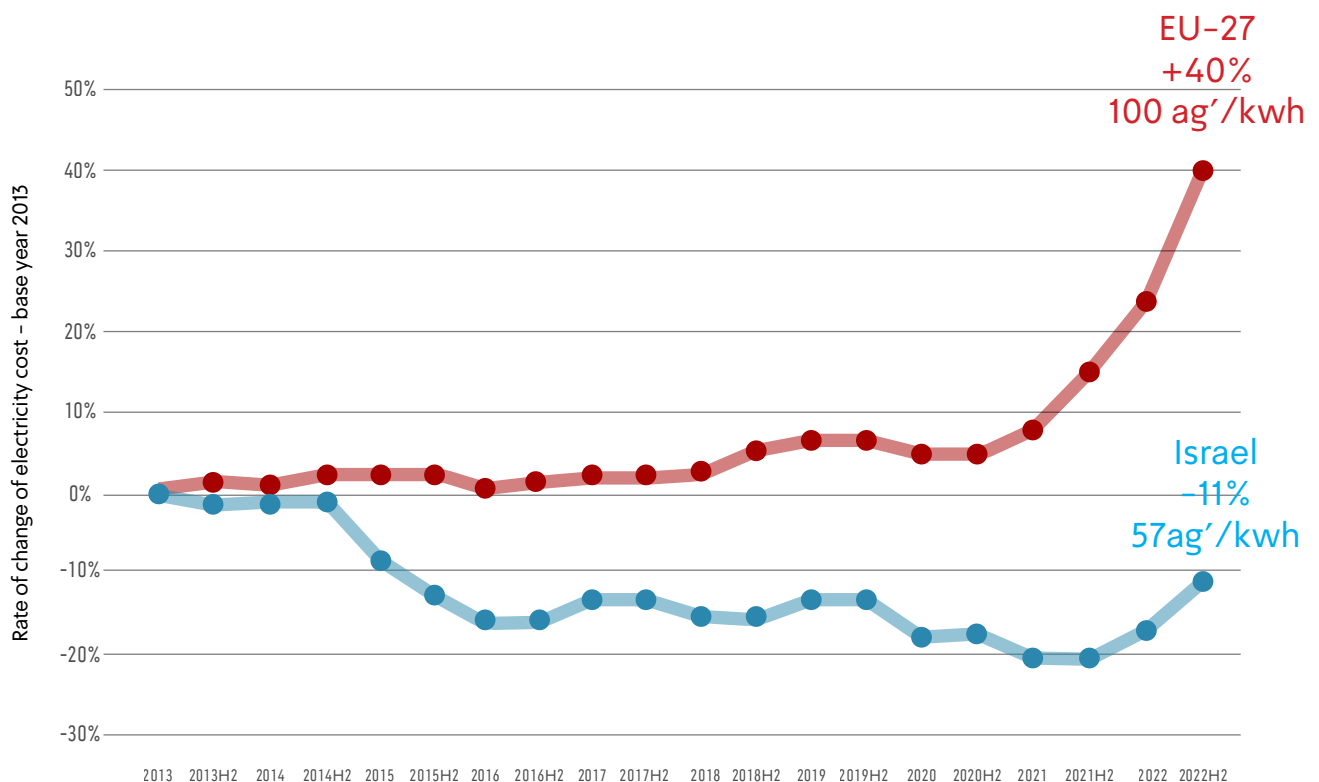
Average price \$/MMBTU 11.8

Source: BDO analysis of data in Tamar and Leviathan Partnership reports from April 2013, gas prices in Europe TTF ICE Dutch, in Britain NBP, in the USA Henry Hub, in Japan and Korea – JKM from mid-2014 as published by investing.com

Natural gas reduces cost-of-living

In the past decade the price of electricity for Israeli households dropped by 11%, compared to a 40% increase in Europe

Index of electricity prices for households
Israel / Europe (2013–2022)

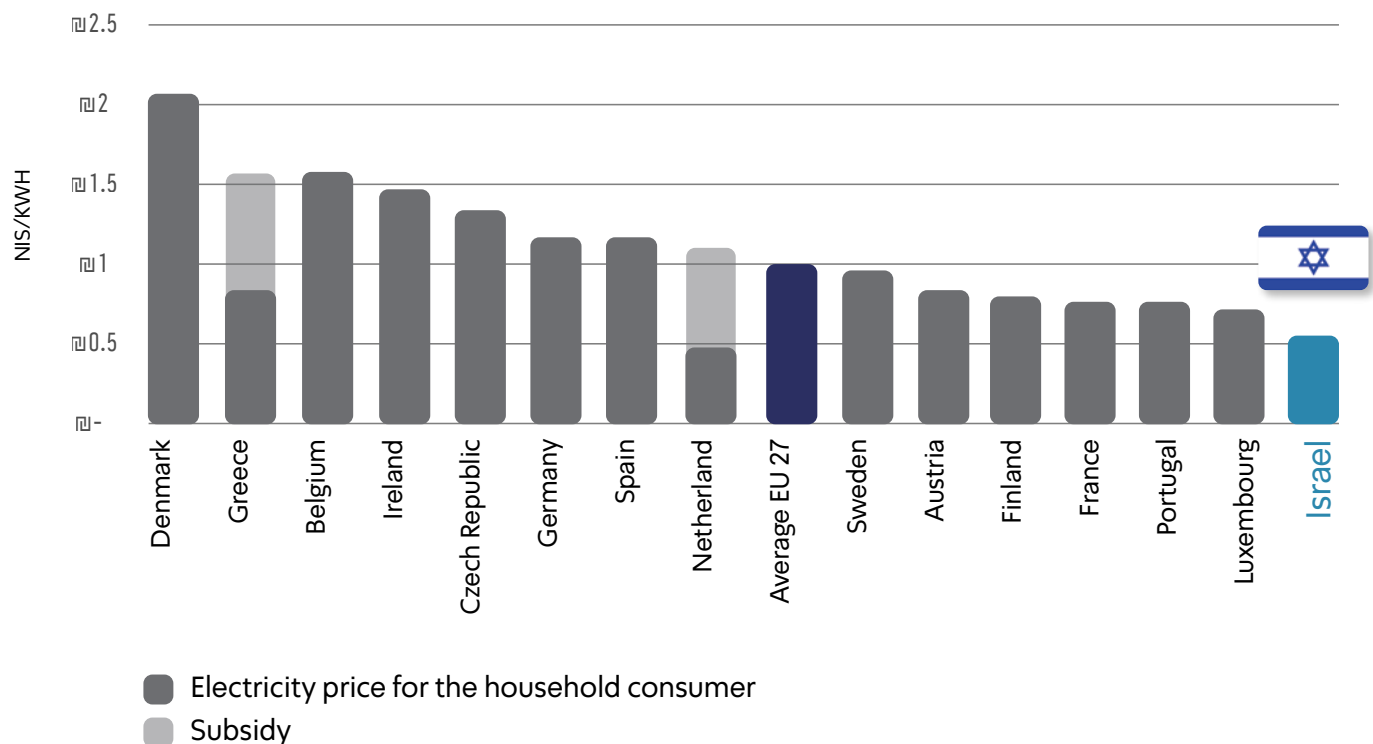


The rate of change of electricity prices in Europe is based on BDO analysis of Eurostat data; the rate of change of electricity prices in Israel is based on IEC data. The prices include taxes and subsidies. Prices in local currency. Average prices (2013 to mid-2022). The increase in electricity prices in Israel over the past two years derives from the increase in price of imported coal.

Thanks to natural gas: electricity prices in Israel are among the lowest in the OECD

The average price of electricity for the household consumer in Europe is almost double the price in Israel. The price in Israel – among the lowest in Europe

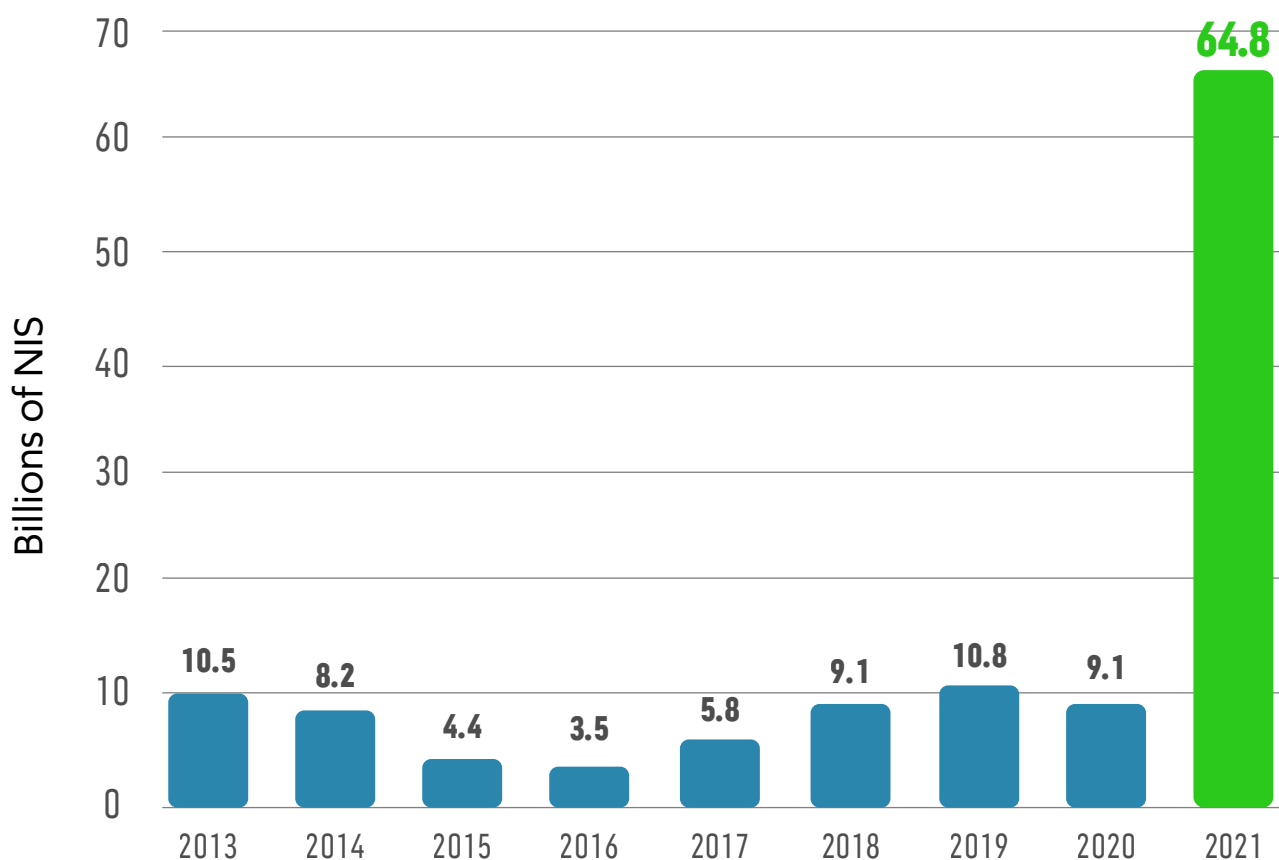
Electricity price for the household consumer
– Israel /EU15 countries 2022 H2 (NIS/KWh)



Source: BDO analysis of Eurostat data (data does not include Britain); Israel - based on IEC data. Data relates to average household consumer prices during the second half of 2022

Thanks to natural gas: the economy saved over NIS 126 billion in energy costs alone

Ministry of Energy estimates concerning savings to the economy as a result of transitioning to gas for electricity production and in industry between 2013 – 2021

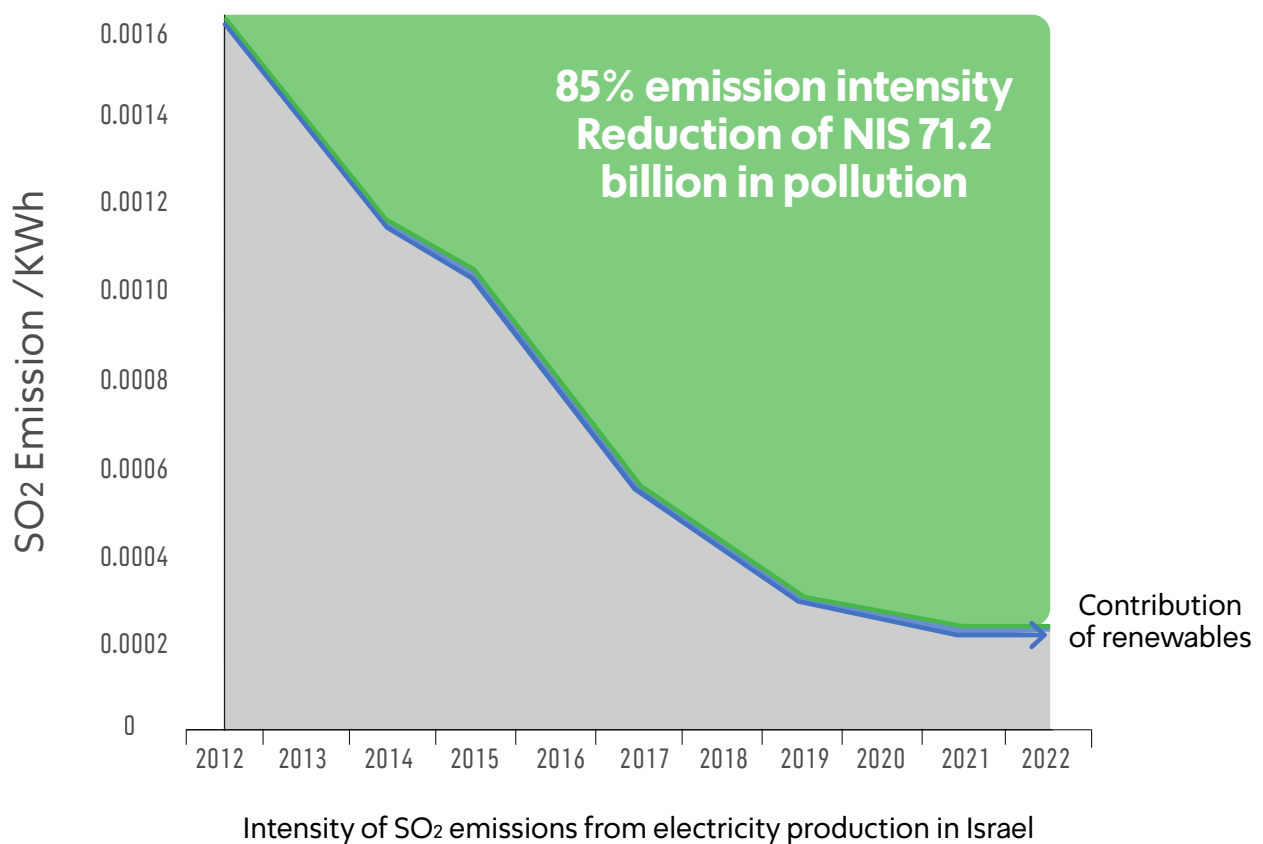


Source: Ministry of Energy estimates. 2013-2021 savings derived from differences in fuel prices only, without the capital investments of establishing power stations and converting to natural gas

*The data does not include savings for 2022

The economy saved NIS 190 billion as a result of dramatic reduction in pollutant emissions intensity

A reduction of 85% in the intensity of SO₂ emission intensity and 76% in the intensity of nitrogen oxide emissions*

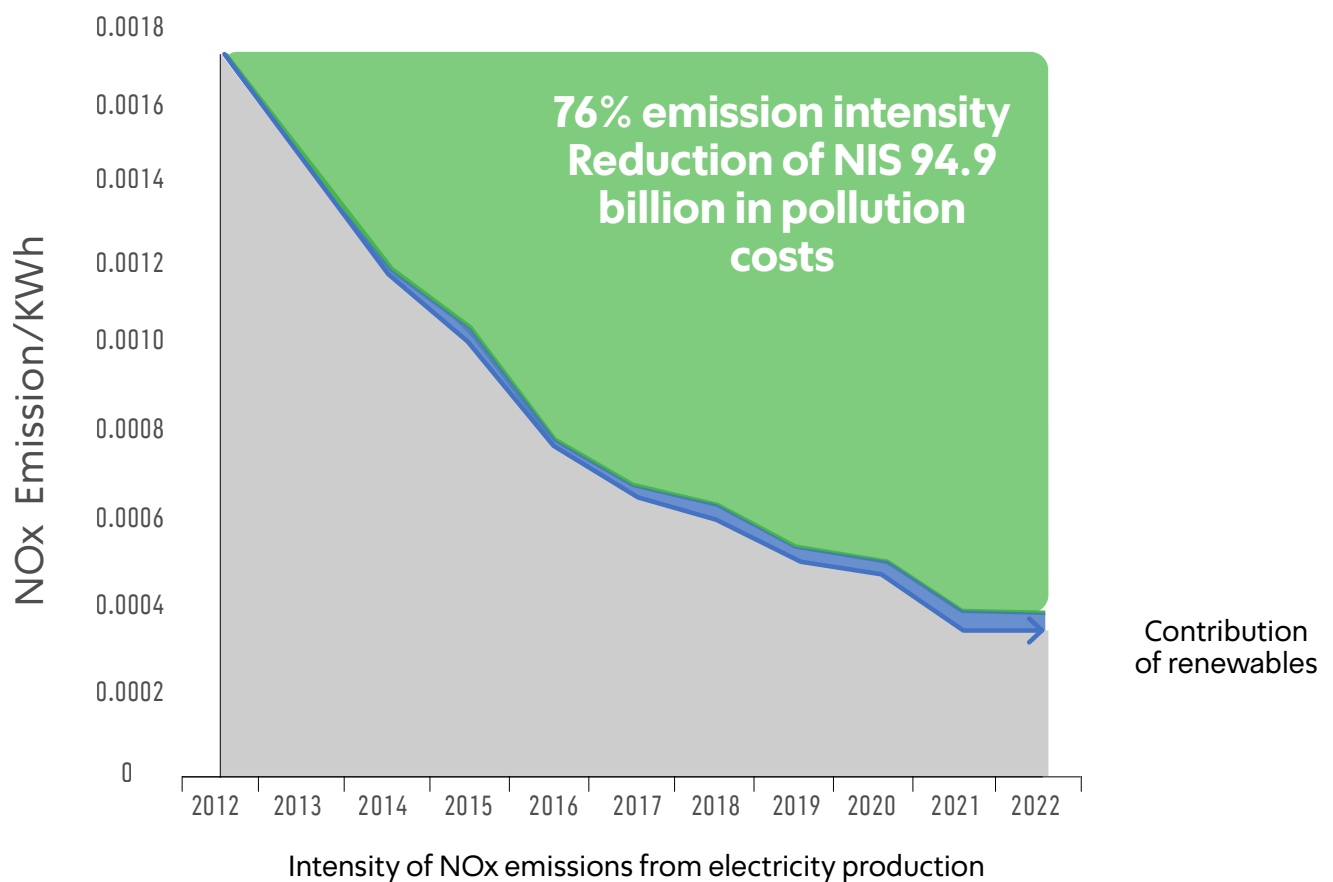


*Not including savings from industry emissions intensity

Source: BDO analysis of electricity economy reports by the Electricity Authority and the Ministry of Environmental Protection "Green Book"

The economy saved NIS 190 billion as a result of dramatic reduction in pollutant emissions intensity

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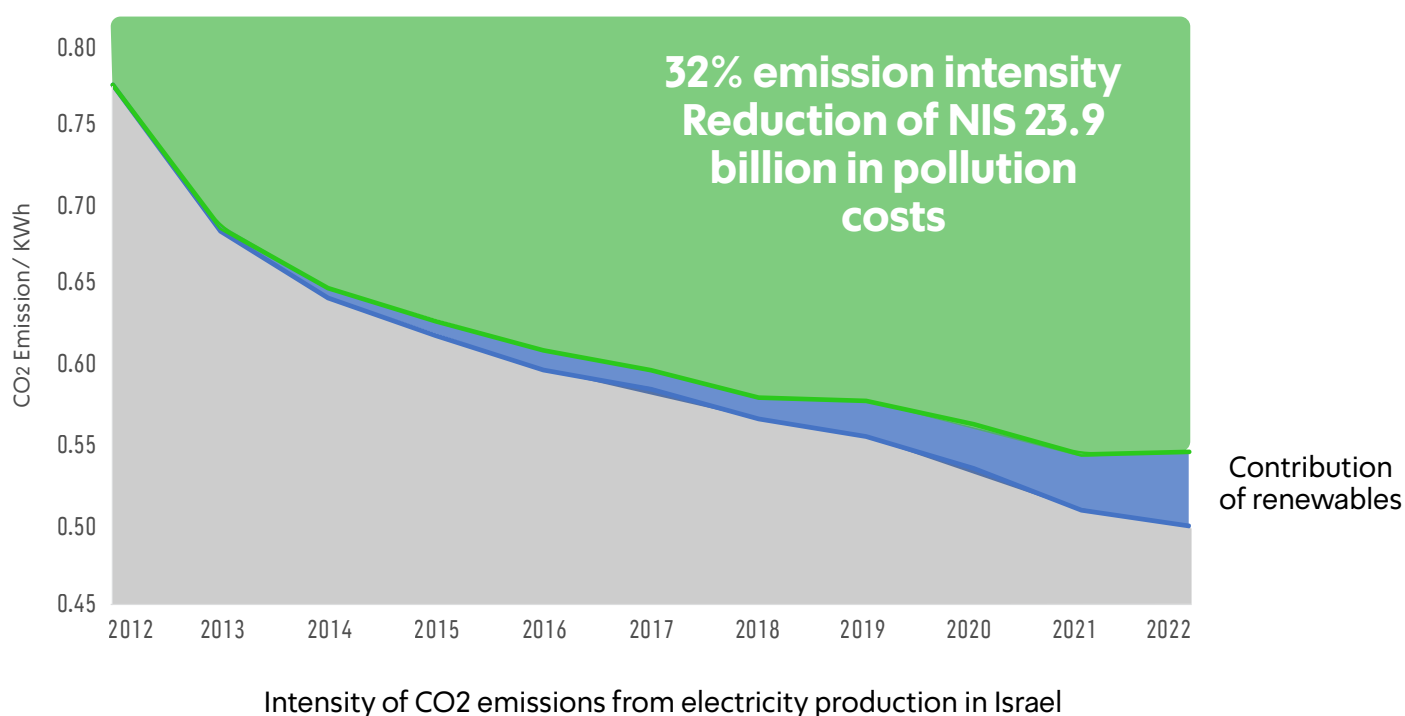


*Not including savings from industry emissions intensity

Source: BDO analysis of electricity economy reports by the Electricity Authority and the Ministry of Environmental Protection "Green Book"

A 32% reduction in greenhouse gas emissions intensity from the production of electricity

Thanks to the transition to natural gas, Israel is one of the leading OECD countries in reducing the emissions of greenhouse gasses per capita*



Source: BDO analysis of the electricity economy report (Electricity Authority) and the "Green Book" (Ministry of Environmental Protection).

*Based on Our World in Data.Org, Israel is ranked 2nd in the OECD for the reduction of CO₂ emission per capita over the past decade ([CO₂ emissions – Our World in Data](#))

Thanks to natural gas An accumulated saving of:



NIS 120,500 per household

Source: Savings in energy costs, Ministry of Energy 2013-2022; Savings in environmental costs as a result of electricity production, BDO analysis of Electricity Economy report data (Electricity Authority) and the "Green Book" (Ministry of Environmental Protection). The average accumulated saving per household for 2013-2022

Thanks to natural gas: an accumulated saving of NIS 316 billion NIS 120,500 saving per household

Billions of NIS

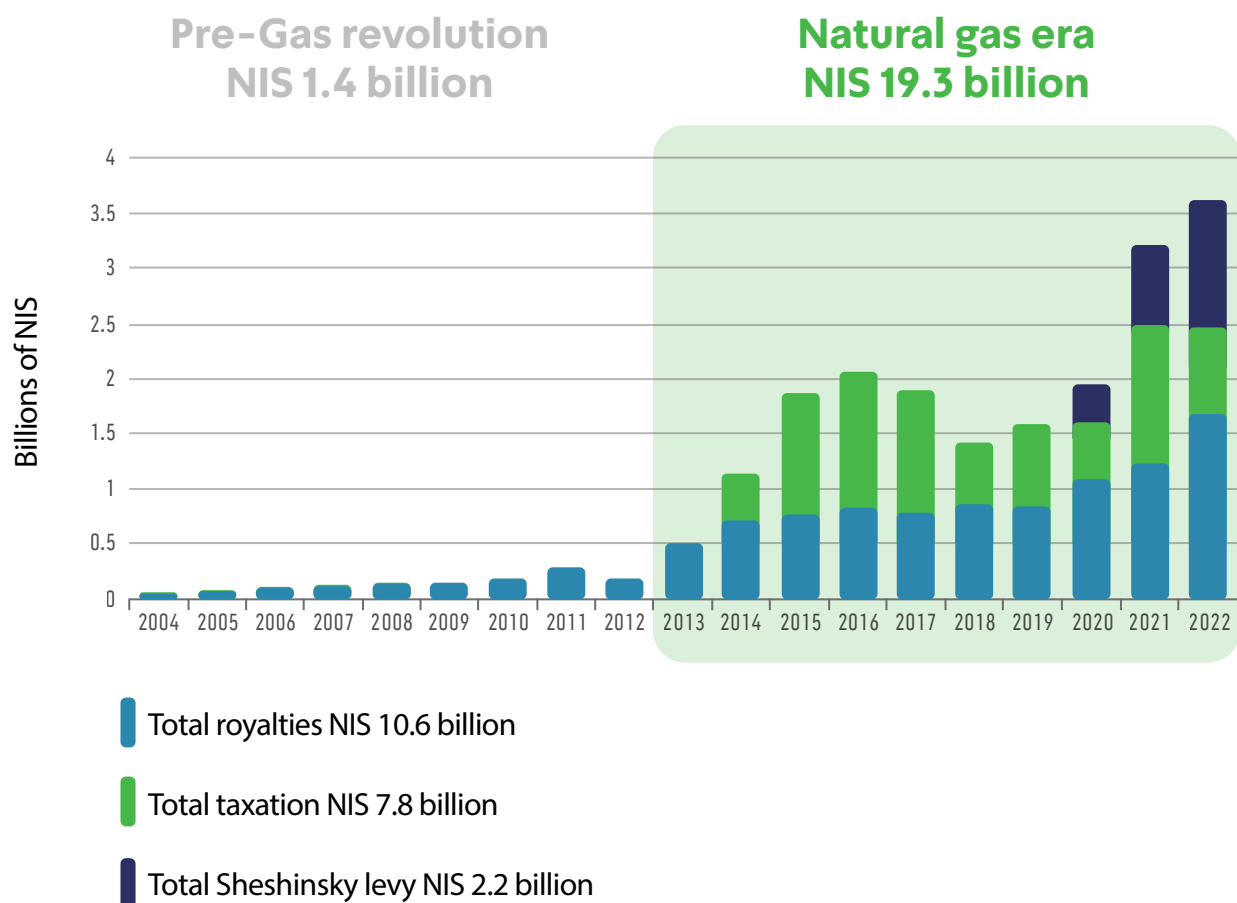


* Savings in pollution – in electricity production, not including industrial pollution, according to BDO analysis of Electricity Economy report data (Electricity Authority) and the “Green Book” (Ministry of Environmental Protection).

*Savings in energy costs - Ministry of Energy evaluation, data refers to 2013-2021 and do not include 2022; added CO2 emissions in natural gas production - data refers to 2013-2021

source: BDO processing of Electricity Economy report on behalf of the Electricity Authority

NIS 19 Billion were paid over the past decade directly to the state treasury

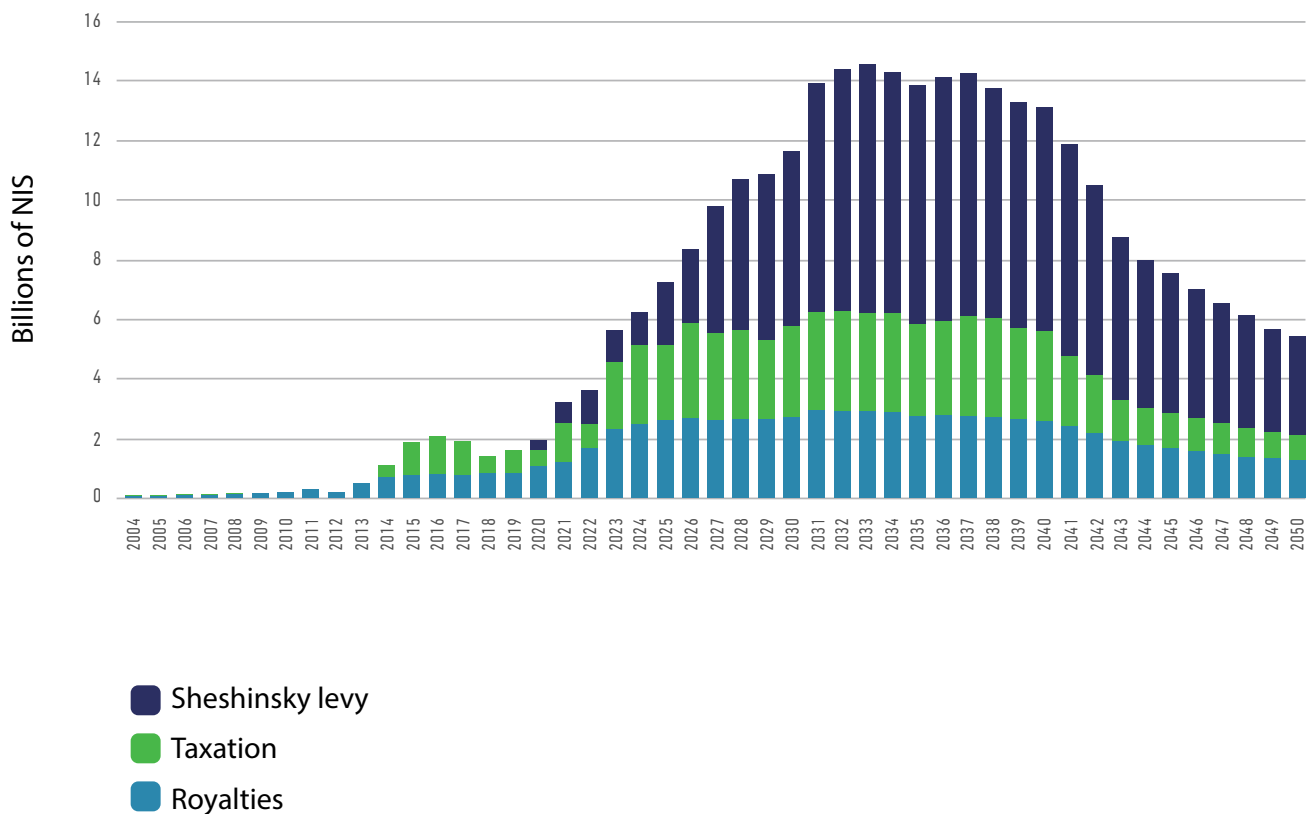


Source – historical data: BDO analysis of Ministry of Energy royalties report, gas companies reports and financial statements; forecast – BDO analysis of reserves reports and gas companies capitalized flow data.

Forecast:

By 2023: another NIS 70 billion
By 2050: another NIS 288 billion

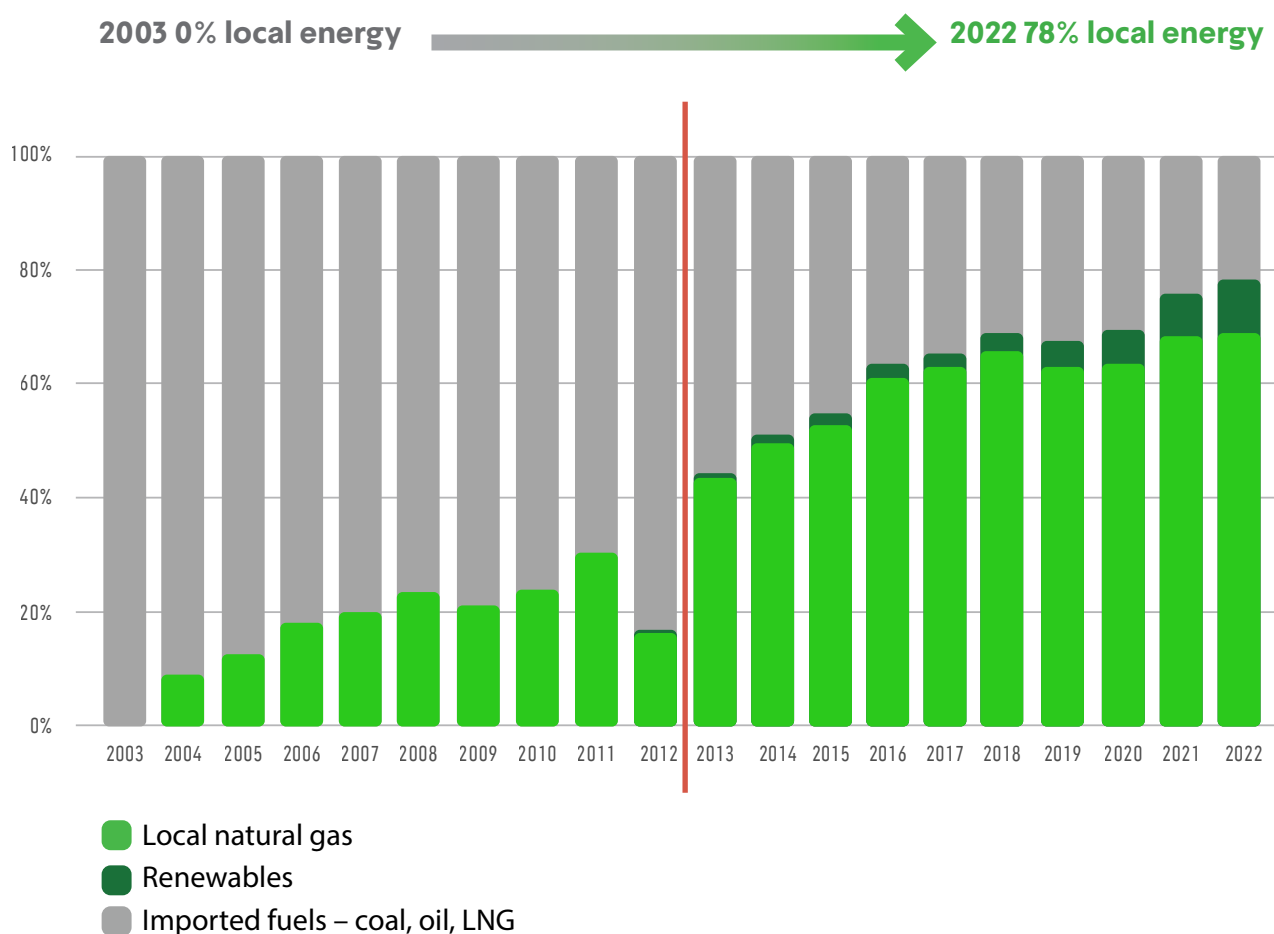
The government take in natural gas profits



Source – historical data: BDO analysis of Ministry of Energy royalties report, gas companies reports and financial statements; forecast – BDO analysis of reserves reports and gas companies capitalized flow data; title relates to years 2023-2030 and 2023-2050

The transition to Energy independence: Local natural gas pushed out imported polluting fuels

As a result of the natural gas revolution – transition from dependence on imported energy to 80% local energy*



Source: BDO analysis of Electricity Authority and Noga data
*On the electricity market

Chapter III

THE CONTRIBUTION OF NATURAL GAS TO ISRAEL'S GEOPOLITICAL RESILIENCE

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Trade Association

The contribution of natural gas to Israel's geopolitical resilience

Israel is a record breaker in future gas retention among the OECD countries; production pace (reserves / annual production) in Israel – about half compared to the large OECD gas producers

Israel is in 3rd place among the OECD countries for natural gas reserves per capita

Within a decade – Israel changed from being an importer of natural gas to becoming an exporter of gas

Since the beginning of the natural gas revolution, several huge international companies have commenced activities in Israel after decades of non-activity

*Revenues from royalties per BCM during 2020-2022

*Among the producing countries

Israel – a natural gas power

Israel is a record-breaker in future gas retention among the OECD countries: the production rate (reserves / annual production) in Israel – is half compared to the

	Reserve BCM	Annual production BCM	Production years (reserve/ production)
Israel 2P	1,087	22	49
Israel 1P	730	22	33
Australia	3,230	147	22
USA	13,170	997	13.5
Norway	1,530	115	13.3
Canada	2,070	182	11.3
*Average			15

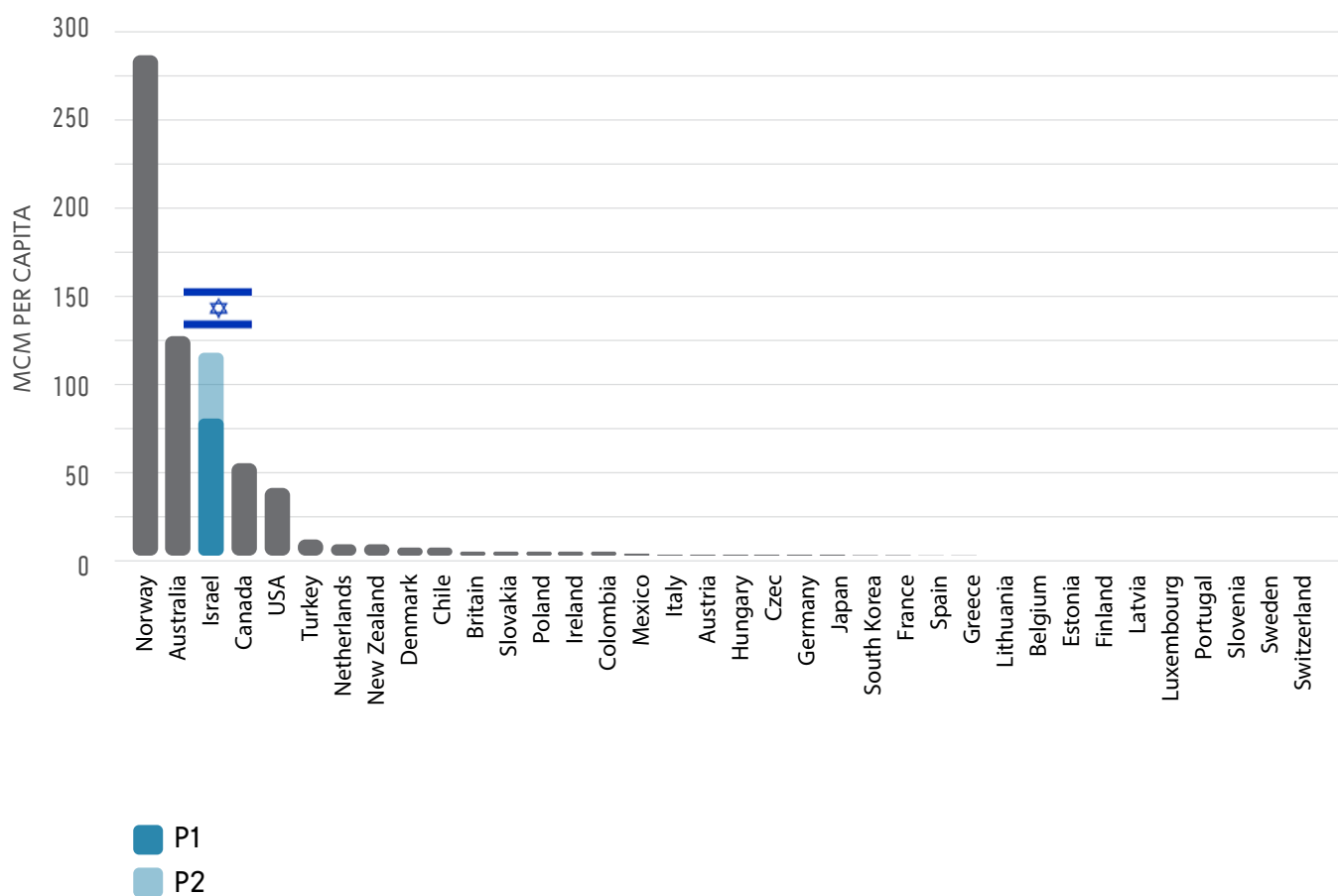
Source: International data: BDO analysis of IEA data based on country reports for 2021; Israel data based on reports by companies holding rights in the gas reservoirs, divided into categories 2P – Proved & Probable Reserves + 1P – Proved Reserves, including Energean discoveries that contain Non-Audited BCM 29

*Among the producing countries

Israel – a natural gas power

Israel is third among OECD countries in gas reserves per capita

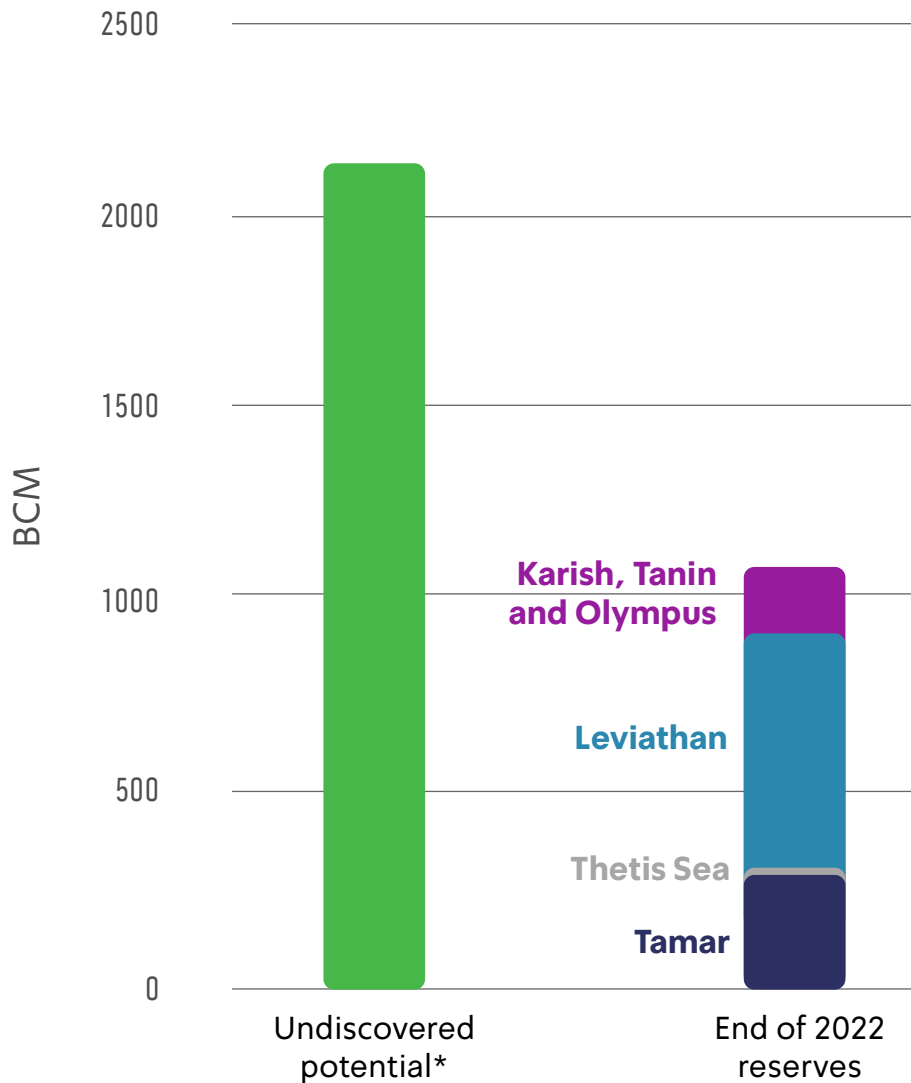
Gas reserves per capita in the OECD countries



Source: International data-2021 data based on IEA data based on country reports; Israel data based on gas company reports, Divided into Proved and Probable categories (1P and difference of 2P)

The Ministry of Energy determines:

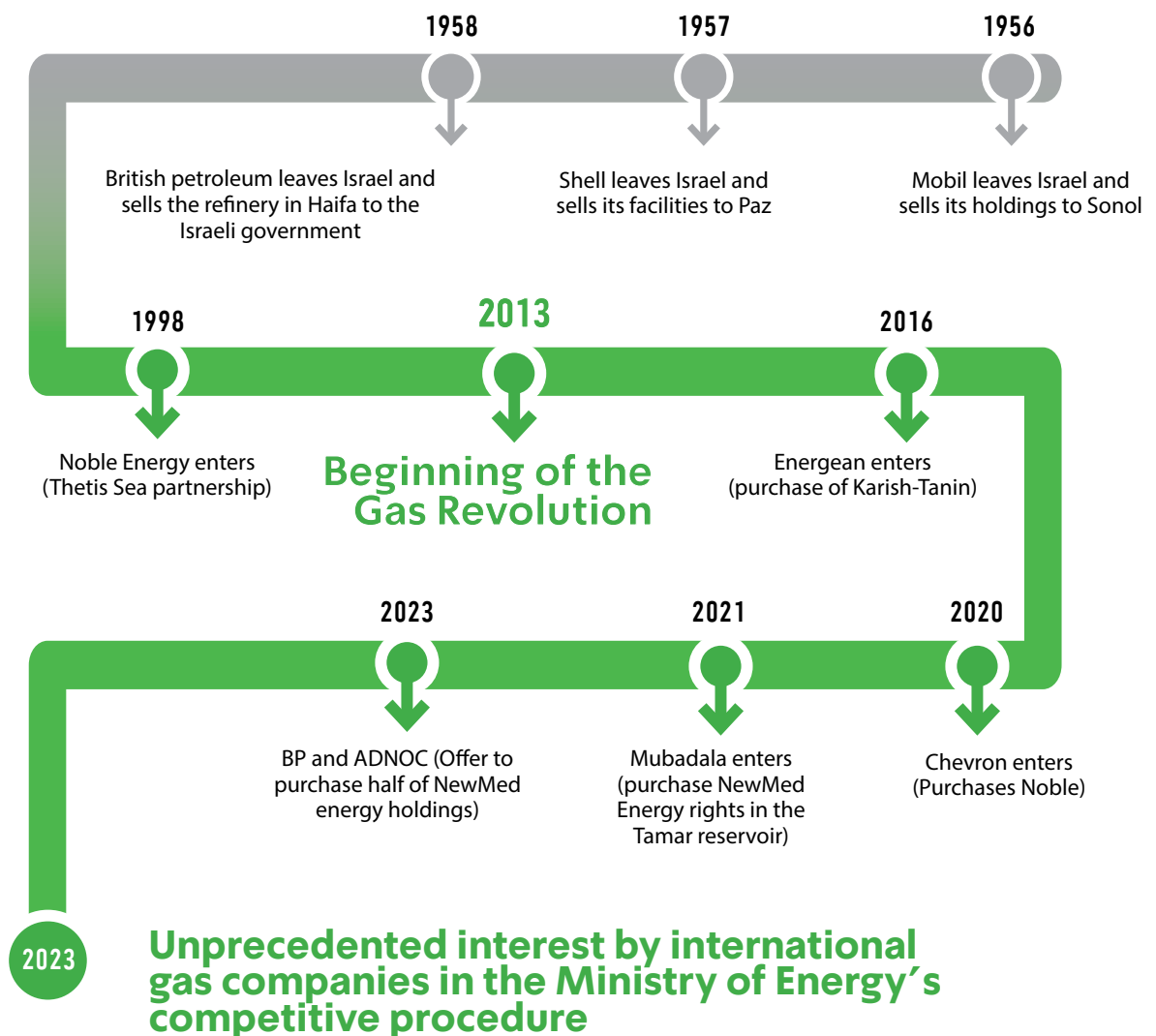
Potential undiscovered gas of 2100 BCM – double the amount already discovered



*Undiscovered potential – based on Ministry of Energy 2018 (Dr. Michael Gardush, Levant Basin Hydrocarbon potential and future development); End of 2022 reserves BDO analysis: based on estimates by independent assessor on behalf of the gas companies, as published in their financial statements. The data includes categories 2C, 2P and the Energean discoveries – Karish North and discoveries in the Olympus region included Non-Audited 29 BCM

Thanks to the natural gas revolution:

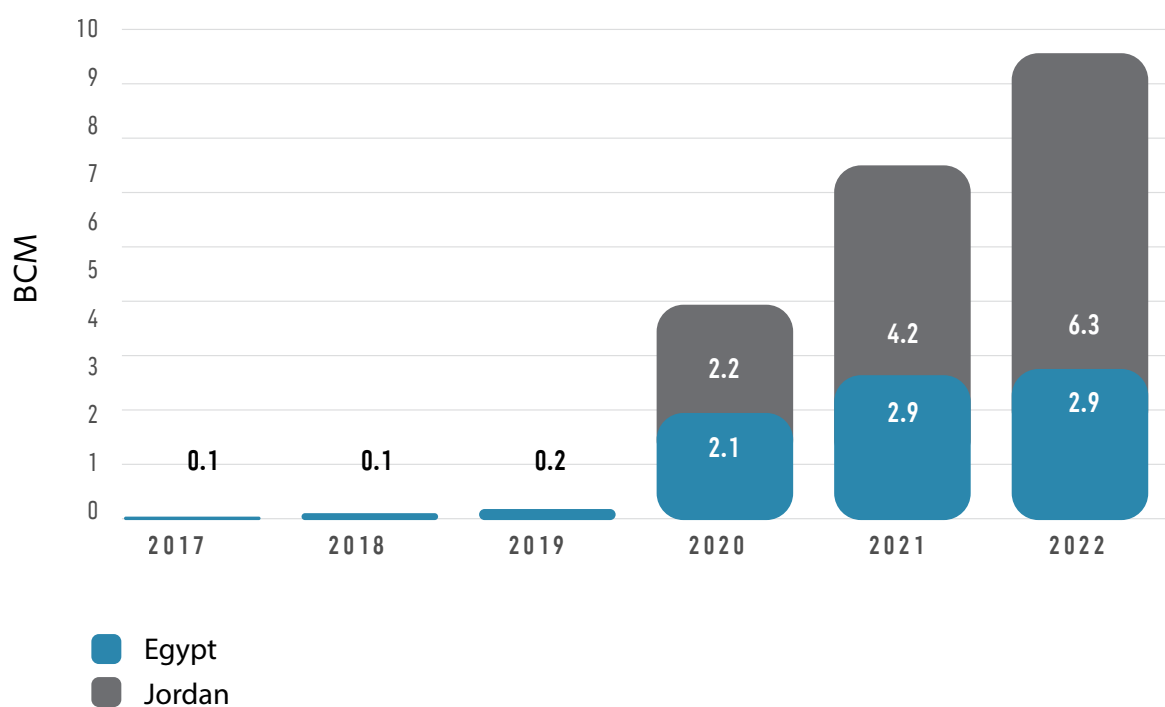
International energy giants have commenced activity in Israel



Whereas during the country's initial years worldwide energy giants terminated their activities in Israel, the natural gas revolution has resulted in a proliferation of global energy companies' activity in the country

Export of natural gas from Israel

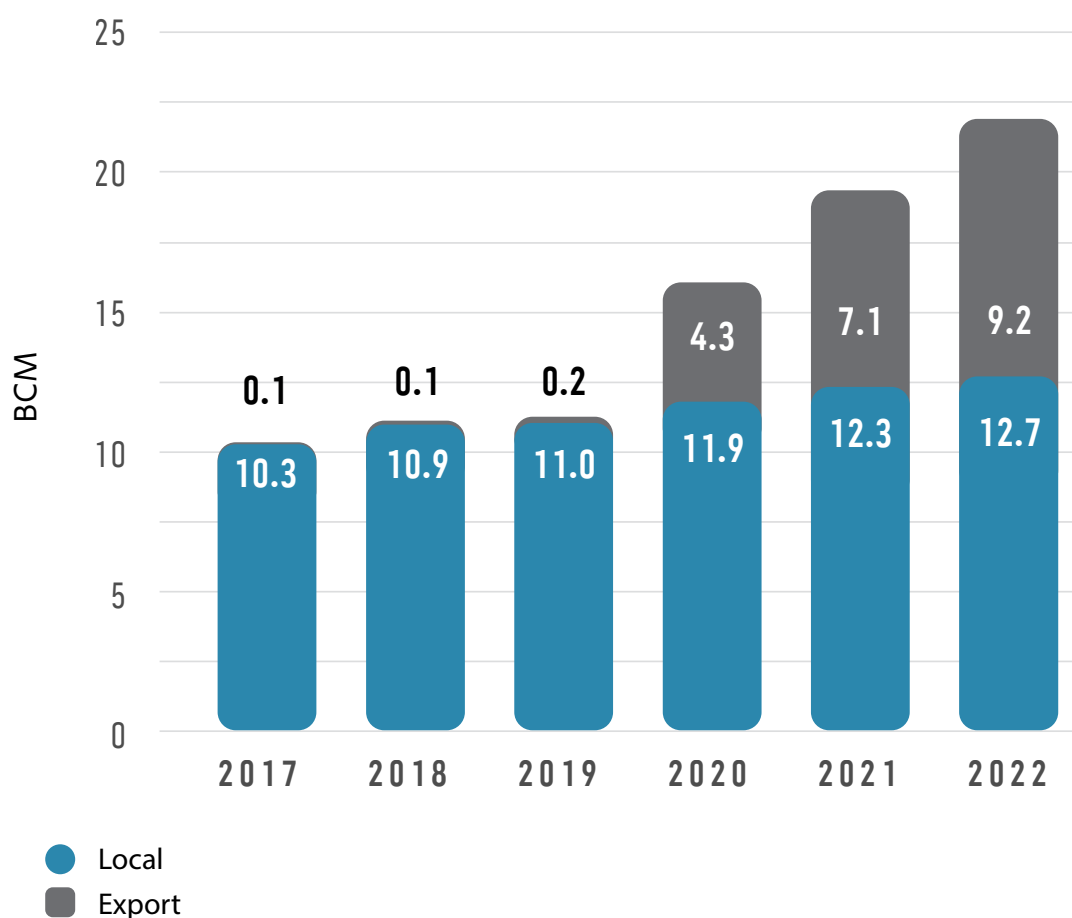
Natural gas exports from Israel according to destination country (BCM)



Source: BDO analysis of gas companies reports

The increase in natural gas consumption in Israel continues alongside the increase in export

Supplying natural gas to the local market and for export



Source: BDO analysis of Ministry of Energy data, royalties reports and gas company reports

ACCORDING TO THE CHIEF ECONOMIST REPORT AT THE MINISTRY OF FINANCE:

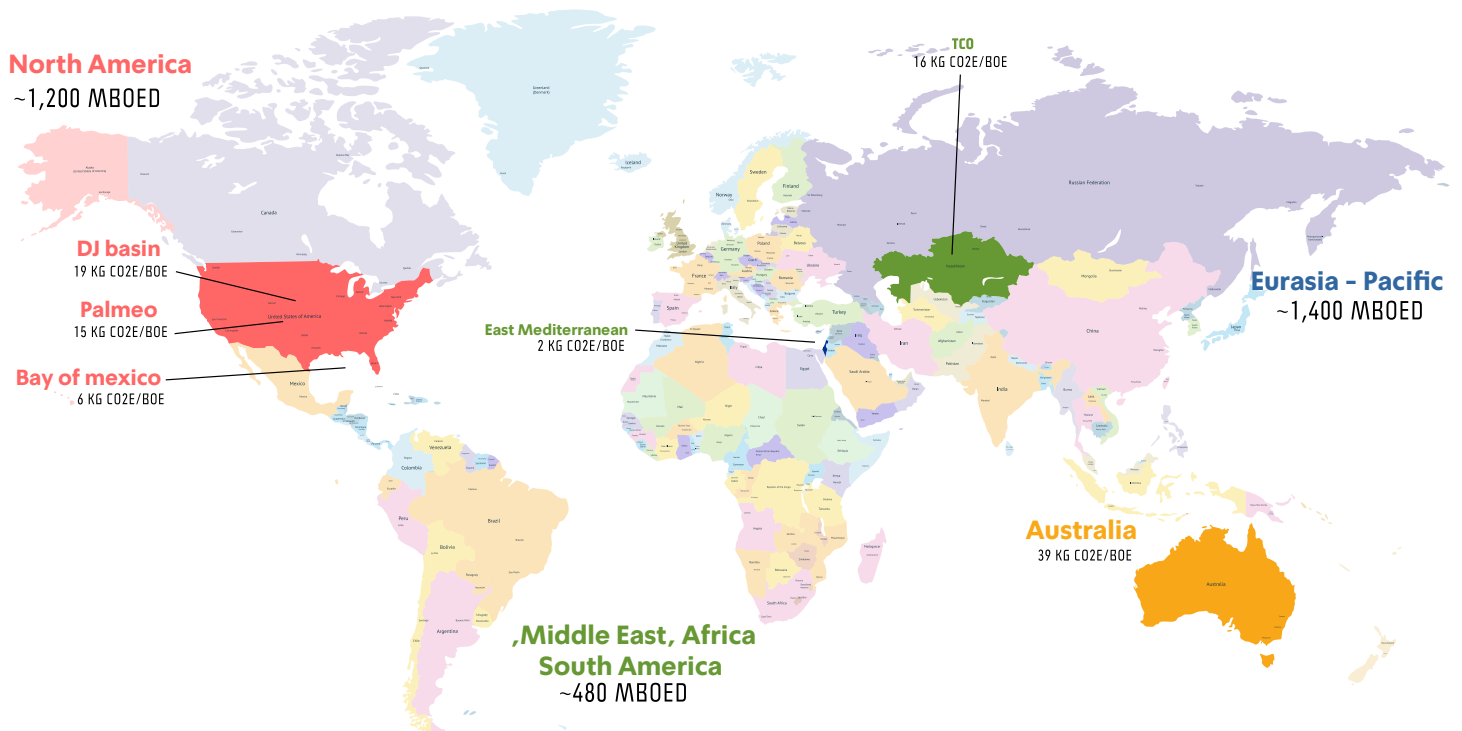
A total expected contribution of 0.5% of GDP growth between 2020–2023 can be attributed to gas exports

Source: Ministry of Finance, Chief Economist's Department: Estimating contribution of the gas sector to long term state revenues (June 2023)

The production of natural gas in Israel: Among the most efficient and clean in the world



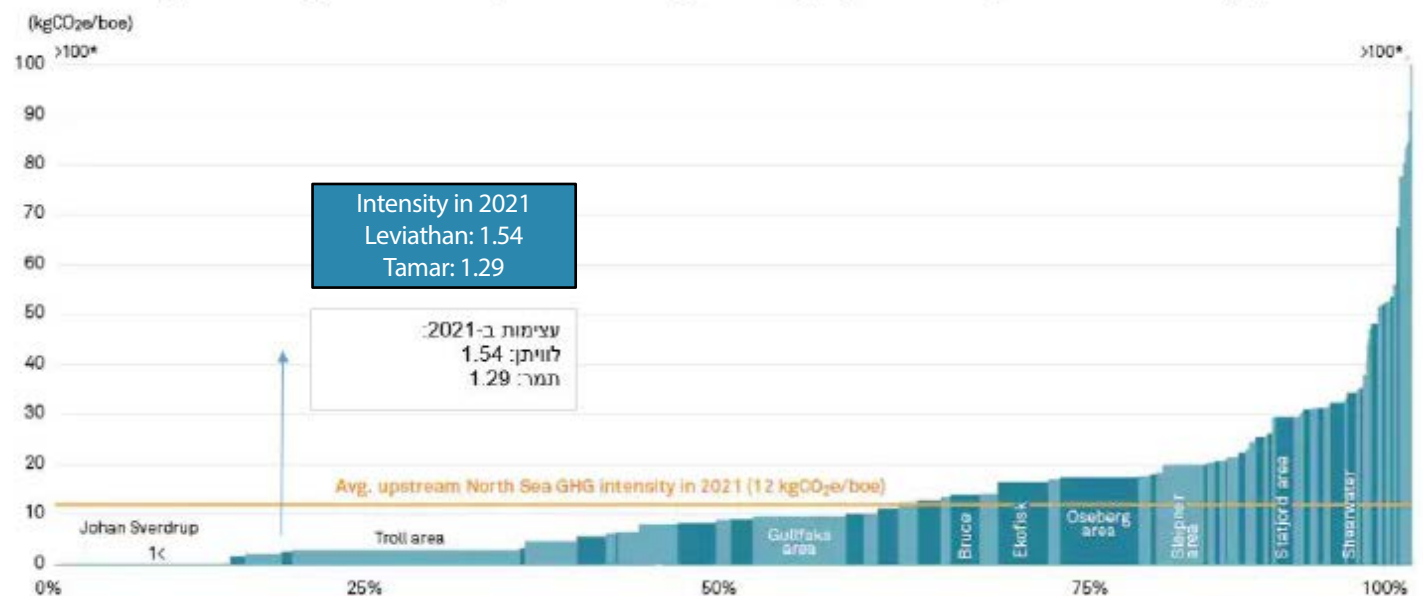
More Israeli natural gas = less emission



Source: [Chevron – climate change resilience \(October 2021\), P45](#)
mboed-Thousands of barrels of oil-equivalent per day

Emission intensity from gas production in Israel is low even in comparison to the North Sea reservoirs

Greenhouse gas intensity of North Sea (UK and Norway) oil and gas production (2021 annual average)



Source: Leviathan and Tamar data – BDO analysis of prescribed environmental emissions data (PEE), Ministry of Environmental Protection – [2021 and gas company reports; North Sea data](#)

BDO Report Editors

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