

Policy Brief

Financing Climate Innovation and Energy Transition



Knesset Special Oversight Committee on the Israel Citizens Fund

Acknowledgment

This policy brief is based upon the testimony of Prof. Glenn Yago on November 16, 2021 to the Knesset Special Committee on the Israel Citizens' Fund¹ at hearings concerning mid- and long-term use of natural gas reserves. This testimony is derived from ongoing research at the Jerusalem Institute's Milken Innovation Center about Israel's Sovereign Wealth Fund and the financial challenges of climate smart policy. We are grateful to the Special Committee's Knesset members and staff for their invitation. Also, thanks to Dinah McNichols, Steven Zecher, Orly Movshovitz-Landskroner, Milken Fellow Hovav Alster and Dr. David Naveh for their edits and comments.

About the Milken Innovation Center

Milken Innovation Center's work focuses on developing market-based solutions to Israel's greatest challenges as it transitions from a start-up nation to a global nation. Our goal is to accelerate economic growth, build human capital, and cement Israel's role as a pioneer in addressing global challenges in water, food, education, health, and energy with solutions that others can replicate.

The Blum Lab for Developing Economies is part of the global network of Blum Centers for Developing Economies based at the University of California-Berkeley enabling interdisciplinary problem solving in key areas of energy, health, technology, food, water, health, and other challenges to sustainable development.

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¹ Previously Knesset Special Oversight Committee on the Fund to Regulate State Revenues from Levies on Gas and Oil Profits.

In one of history's greatest setbacks, the Eastern Mediterranean, once the cosmopolitan center of global commerce and connectivity,² is paying the price in isolation, low productivity growth, capital flight, and limited investment for five centuries of imperialism, war, corruption, autocracy, political fragmentation, and violence.³ It now also faces acute challenges related to global warming and energy transition.

But just as crucial signs warn that things must change, we find encouraging signs that they will. Geopolitical, environmental, and economic interests are aligning in such a way that could, if we let them, rebuild inter-regional trade; propel economic growth, climate change mitigation and adaptation; and lay the groundwork for sustained cooperation and reconnection on social and cultural levels.

COP 26, the UN's committee of nation's participating in climate smart policies and practices in Glasgow earlier this month, was not the resounding success many had hoped for, despite admonitions that we have just a few decades remaining to act to prevent several major tipping points in the Earth's climate system. Leaders of the world's major powers, Russia, China, and Brazil among them, stayed away. Still, an overwhelming number of countries plus five development banks pledged to stop using public funds to finance overseas "unabated" fossil fuel projects, i.e., those operating without technology to capture and sequester carbon, and instead resolved to redirect those funds to support overseas green energy technologies and implement plans for carbon sequestration, renewable energy storage, and other breakthrough climate innovations.

This has implications—and time frames and funding mechanisms to review—for the natural gas markets of the Eastern Mediterranean. We face both opportunity and a closing window.

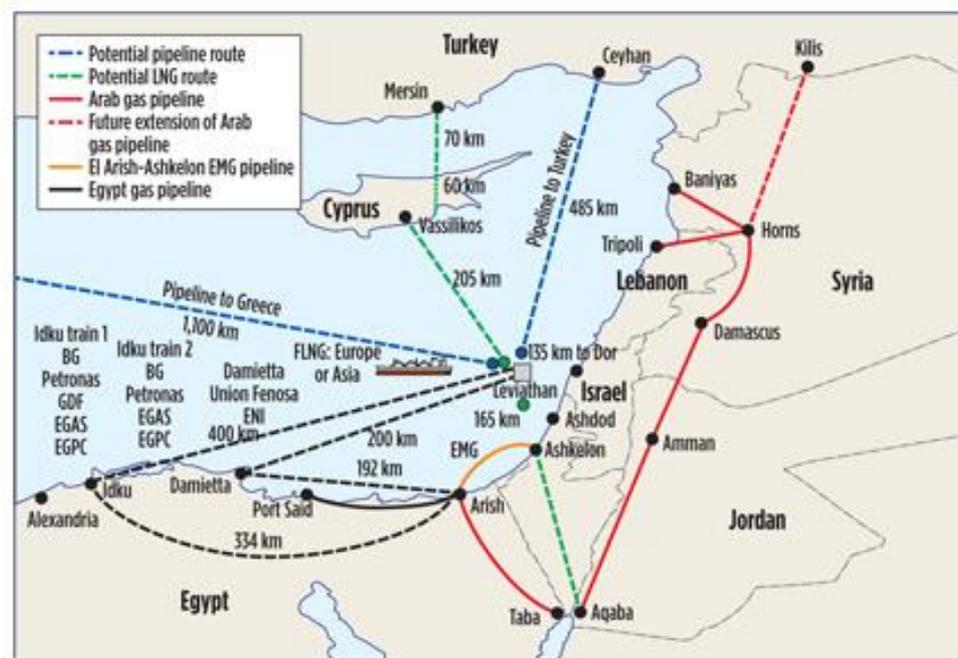
Opportunity is identified in a recent study of the Eastern Med natural gas markets, which concludes that regional suppliers will need to focus on domestic, regional, and European markets, as well as the Middle East and North Africa (see also Figure 1). We must also be

² Fernand Braudel (1972), *The Mediterranean: The Mediterranean world in the Age of Philip II*, Vol.2, New York: Harper and Row; David Aboulafia (2011), *The Great Sea: A Human History of the Mediterranean*, London: Penguin Books

³N. Grigoriadis and C. Levoyannis (2021), "Winds of Change in the Eastern Mediterranean: Between Hydrocarbons and Renewable Energy Geopolitics," Athens: Hellenic Foundation for European and Foreign Policy, Policy Paper 80.

mindful of the growing competition from Russia and Turkey which requires Eastern Mediterranean producers to accelerate the development of a strategy to build a regionally integrated energy market for a decarbonizing world. And we must invest in abatement mechanisms, and technologies and initiatives, that support “a combination of gas and renewables to accelerate cleaner power-generating models and improved electricity access and interconnectivity” as the region moves along the energy transition curve.⁴

Figure 1: Potential Markets for Israeli Natural Gas Export: Value Capture for Energy Transition



Source: Cohen, 2018.⁵

There is no “one size fits all” solution for energy transition, but if Israel can optimize a number of diverse solutions, this will help manage risk as the region works toward achieving net-zero emissions reduction (carbon neutrality) by midcentury. The path forward requires evidenced-based policies that embrace the complexity of an integrated energy transition. Success could mean that the Eastern Med, previously energy-poor, will be able to monetize its new energy

⁴ Emily Stromquist (2021), “East Med Gas Needs Cleantech and Regional Integration to Support Investment Case,” Middle East Institute.

⁵ Gina Cohen, Response to Interim Committee’s Recommendation to examine government policies on natural gas in Israel, August 12, 2018.

sources of both natural gas and renewables to finance technology solutions for energy transition.

Clearly, Israel cannot be left behind, sitting on what will eventually become obsolete, non-performing, stranded assets. The window is closing for monetizing these gas reserves to build trade, energy, and sustainable investment flows; but fortunately, its closure coincides largely with the remaining life span, estimated between 18 and 25 years, of our proven gas reserves.⁶

This also has implications for our long-awaited sovereign wealth fund, the Israel Citizens Fund (ICF), and for finally getting it right under conditions that have ripened since the inception of these ideas a decade ago. In 2011,⁷ when we began work designing the Fund, there were 56 sovereign wealth funds worldwide; today there are 134. And their investment strategies are changing with the times. In a survey on climate-related investment of the world's largest sovereign wealth funds, respondents reported a total 2020 investment of \$2.3 billion in climate investments, more than double the \$1.1 billion they had invested in 2019.⁸

The imminent launch and projected growth of the ICF over the next decade, and its arrival to the world of sovereign wealth investors and regional partners, can spur Israel's transition from a startup nation to a global innovation nation deploying its capacity to deploy its climate-change technologies.⁹

The model in Figure 2, based on research at the University of Haifa and Technion, suggests some optimal allocations of natural gas (and other resource) extraction over time.¹⁰ The model depicts the macroeconomic dynamics for a general equilibrium investment scenario that the ICF can achieve by capturing and optimizing the value of natural resource taxes through the government take (the total amount of revenue that a host government receives

⁶ Adiri Committee (June)2021, "Second Periodic Report of Professional Committee Examining the Government's Policy Regarding the Natural Gas Market," Draft for Public Comment (Hebrew).

⁷ Milken Institute Financial Innovations Lab (2011), "Structuring Israel's Sovereign Investment Fund: Financing the Nation's Future."

⁸ International Forum of Sovereign Wealth Funds (2021), "Mighty Oaks from Little Acorns Grow: Sovereign Wealth Funds' Progress on Climate Change."

⁹ "Thinking Differently about the Israel Citizens Fund" (2020), Policy Brief, Milken Innovation Center-Jerusalem Institute for Policy Research.

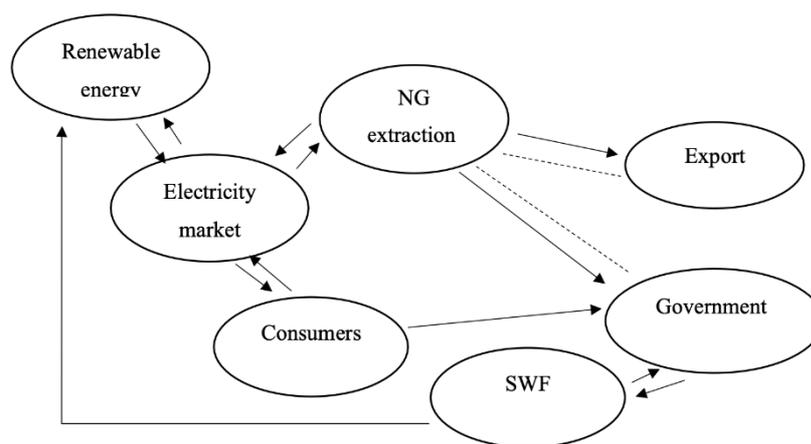
¹⁰ Hala Abu-Kalla, "Intergenerational Allocation of Exhaustible Natural Resources," Ph.D. dissertation, Faculty of Management and Department of Natural Resources and Environmental Management, University of Haifa, 2020

from natural resource extraction through taxes, royalties, and government participation). In Israel, this was defined from government decisions referred to as Sheshinski 1-natural gas and Sheshinski 2-other natural resource taxes on potash, bromine, magnesium, and other products and byproducts, assuming they are levied by the Israel Tax Authority. The government then transfers a share of tax income directly to consumers through the Government budget and through transfers to the ICF.

The Fund invests in assets outside the country (to counteract large inflows of foreign exchange that would otherwise cause the currency to over-appreciate) as well as in non-inflationary investments in R&D for clean technology (renewables and energy efficiency) and other disruptive technologies. The returns on these investments will compound and create intergenerational wealth through the self-sustaining ICF.

Figure 2 describes the schematic model for growth based upon the result of SWF investment (and greater investment it can leverage through capital market solutions) in renewable energy and energy efficiency new technologies including carbon sequestration, storage, and renewable energy. Improvements in total benefit to the economy through electrification, consumer utility and inter-generational productivity and consumption gains emerge from investing in next generation of renewable energy technologies.

**Figure 2: Model of Value Capture of Natural Gas and ICF Flows:
Schematic investment invested in Energy R&D productivity**



Source: Hala Abu-Kalla., 2020: 108; Ayalon, 2021.⁹

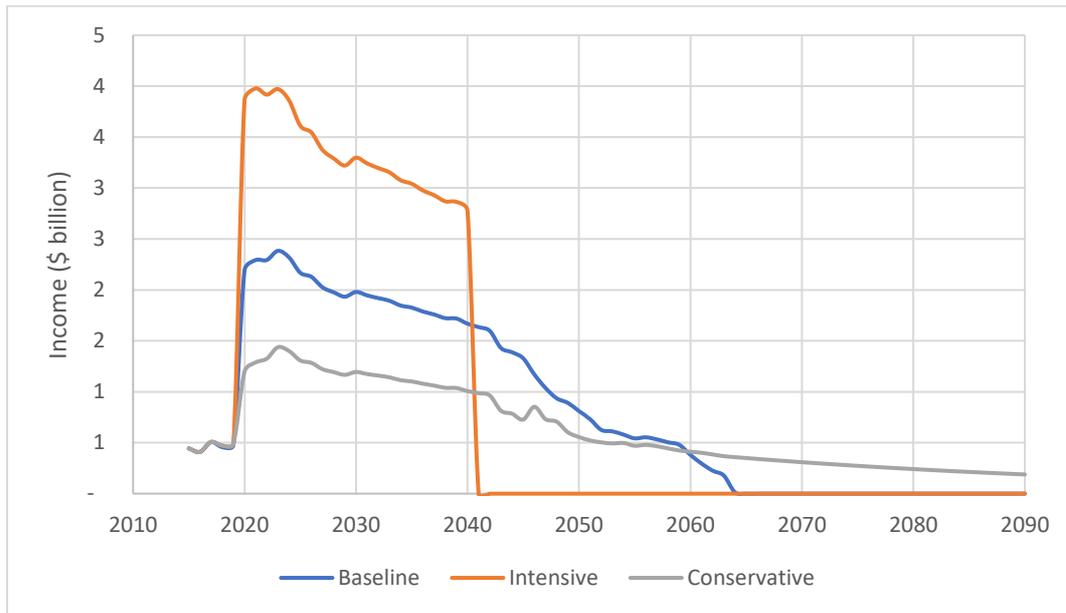
⁹ Ofira Ayalon, Presentation to Special Committee on ICF, Knesset, November 16, 2021; Hala Abu-Kalla et al., "Hoard or Exploit? Intergenerational Allocation of Exhaustible Natural Resources," *Energies*, December 14, 2020.

Total economic benefits are highest under the intensified extraction scenario. Figures 3 and 4 show the effects of three different rates of extraction (baseline, conservative, and intensified) between 2021 and 2040 on intergenerational economic welfare, and inform the ongoing discussion about the optimal design for Israel's sovereign wealth fund, which should clearly include new strategic climate investment. This model also suggests that the option of intensifying and accelerating the exploitation of natural gas and other natural resources will maximize the Fund's capacity to help finance a net-zero diversified energy portfolio and avoid the constraints that stranded assets would impose on energy transition.¹⁰ As gas exports enrich the Government's take, the revenues can target investments that promote R&D in renewable energies, carbon capture, and sequestration; green building efficiency, hydrogen and improve renewable energy and carbon storage technologies that will help Israel, and its regional and world partners to accelerate climate-smart energy transition.

Figure 3 depicts the Government take from natural resource extraction, according to the three scenarios, while Figure 4 shows how the value of the ICF aligns with each. In both figures, the scenario of intensive extraction over the period results in the highest revenue for the Government. This enables both a greater contribution to energy transition by 2040 and greater value for the ICF. The higher extraction rate resulting in greater ICF returns for R&D will also improve and expand the opportunities for renewable energy projects; increase electricity production required for transportation, industry, and other needs for the fourth industrial revolution to a digital economy; and optimize consumer utility, which exceeds direct income transfer and accelerates economic growth.

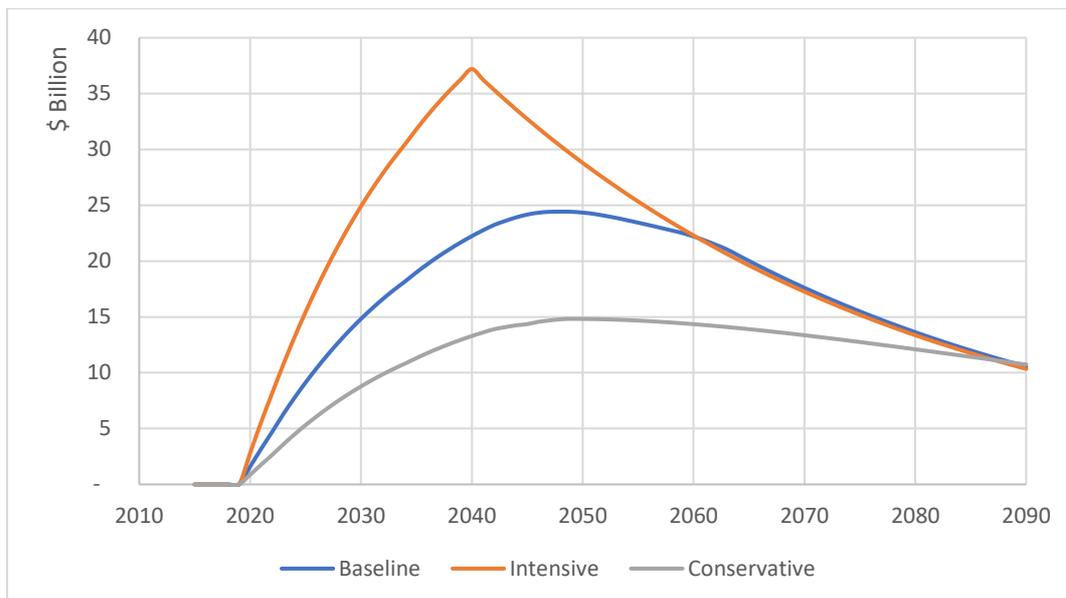
¹⁰ Hala Abu-Kalla et al., "Hoard or Exploit? Intergenerational Allocation of Exhaustible Natural Resources," *Energies*, December 14, 2020.

Figure 3: Government Take Over Gas Field Lifetimes, under Different Scenarios



Source: Hala Abu-Kalla, et.al. 2020.

Figure 4: Sovereign Wealth Fund Value over Gas Field Lifetimes, under Different Scenarios



Source: Hala Abu-Kalla, 2020.

The scenarios suggest the potential resources that become available to accelerate technological progress, including scientific and engineering process, and human capital as

drivers of long-term sustainable economic growth for building new energy sources for future generations.¹¹

Rising Price Projections Bode Well for Launching the ICF and Regional Strategies

There is nothing mutually exclusive about the formation of the ICF and the path toward regional integration, clean technology, and economic development. We stand by our conviction that the ICF should have dual aims: (1) to serve as an investment vehicle to build long-term savings; and (2) to use compounding financial returns and asset appreciation over time to target policy objectives once the Fund achieves certain benchmarks.

Even with the revision in 2020 by the Israel Tax Authority of anticipated ICF revenues, the Fund's potential dividends could reach \$700–\$1 billion annually to bolster spending beyond existing budgets under the 3.5% allocation of 57% of the Government take in natural resource-linked revenues under an enforceable tax regime. Today, the Israel Tax Authority estimates that ICF funding will total more than \$10 billion by 2030 and, ultimately, to \$44.0–\$57.4 billion, subject to the rate of natural gas depletion from facilities currently operational, and future extraction from proven reserves.¹²

The consensus forecast for natural gas prices for 2021 from the four leading sources—the US Energy Information Administration (EIA), the International Monetary Fund (IMF), World Bank, and the Canadian Government—is \$2.81/MMBtu, which is 39% higher than in 2020.¹³ Natural gas futures and longer-term natural gas price projections suggest a larger Fund could be achieved with an intensified extraction rate for export and decarbonization, eliminating coal. This would accelerate not only tax revenues to the fund but also investment in clean technology storage and mitigation, and marginal cost abatement for adaptation of new renewable energy technologies. Israel has a great amount of unutilized greenhouse gas abate

¹¹ The Committee for the Prize in Economic Sciences in Memory of Alfred Nobel (2018), "Economic Growth, Technological Change and Climate Change." See also P. Aghion, T. Beck, and R. Levine (2018), "Financial Development and Innovation-Led Growth," Handbook of Finance and Development, London: Edward Elgar, 2018. A great deal of the practical analytics derives in part from the Nobel Prize (2018) awarded to Paul Romer and William Nordhaus in Economic Sciences and should be integrated in our policy analysis of energy transitions.

¹² Israel Tax Authority (2021), Presentation to the Knesset Committee on the Israel Citizens Fund, "Tax Laws and Profits from Natural Resources," October 12 (Hebrew); State Comptrollers Report (2021), Ministry of Energy, "Effectiveness of the Implementation of the Natural Gas Arrangement," Critical Report No. 72A, Part 2, August (Hebrew).

¹³ Knoema (2021), "Natural Gas Price Forecast: 2021, 2022 and Long Term to 2050," November 12.

potential both for its own energy transition and technology transfers that would accelerate green gas abatements through inter-regional trade and learning by doing in other countries.

We can monetize natural gas assets into the permanent fund (and not rely on government budgets) to channel returns into investments in technologies that can, for example, address marine protection zones and conservation, and stop Mediterranean Sea acidification; enable low-carbon energy transitions; build cultural heritage tourism; promote desert and sustainable development technologies; and drive economic growth.

Increasing Eastern Med regional cooperation with Greece, Cyprus, Egypt, Jordan, and the Palestinian Authority can help end energy poverty in the Middle East and, in particular, North Africa, where more than 65 million people have no access to electricity and another 60 million live with prolonged power outages and undersupply.¹⁴

New Money, More Money and Lessons from other Sovereign Wealth Funds

Nonetheless, Israel must update its decade old ICF mandate. If we want to build a fund that carries weight and influence with greater capacity for diversity and growth, we should follow the successful strategies of SWFs in Singapore, Saudi Arabia, UAE, China, Italy, and Morocco, among others. The original model of traditional commodity revenue sources is outdated and insufficient in a rapidly changing world. The ICF needs to go beyond natural resources alone and enlarge its capitalization to finance the future. This means including, as those successful sovereign wealth funds do, foreign exchange surpluses, revenues from privatizations, budgeting surpluses, governmental transfer payments, unclaimed assets, diaspora bonds, IP rents, and funds raised in the international capital markets.

This kind of expanded sovereign investment portfolio aligns well with carbon-neutrality goals because its managers can design investment portfolios that reduce the Fund's carbon footprint.¹⁵ Already, as we know, the Ministry of Finance has joined over 27 countries and proposed a carbon pricing scheme, and the Fund could dedicate some of those tax receipts

¹⁴ Olawuyi (2020) "Energy Poverty in the Middle East and North Africa (MENA Region)," Energy Justice and Energy Law. F. Lee Godden, et.al. (eds.)Oxford University Press: 254-79.

¹⁵ Patrick Bolton et al. (2021), "Net-Zero Carbon Portfolio Alignment" Imperial College London Business School working paper. This is particularly important for the current governance process under the Bank of Israel Law of 2014 for the management of the sovereign wealth fund.

and leverage sustainability bonds for project finance to help subsidize the next generation of renewable technologies and other zero-carbon technologies for export. In 2021, already 20 countries (including France, Germany, the UK, Colombia, and Spain) have raised more than \$100 billion in sovereign green bonds and sustainability bonds to accelerate energy transitions.¹⁶

The Israel Government, the ICF, and the Development Corporation of Israel (Israel Bonds) could raise low-cost funds under the International Capital Market's Association's Green and Sustainability Bonds principles for energy transition projects and technology development through sustainability bonds, and outcomes-based, sustainability-linked corporate bonds to fund energy transition at home and abroad. Israel could quickly become a launch-pad for disruptive technology issues targeting financial solutions for climate and sustainable development goal challenges. Already, Bank Hapoalim has raised \$1 billion in contingent convertible green bonds, and Teva has issued a \$5 billion sustainability-linked bond tied to climate change and access to global health.

ICF-issued bonds would further leverage the Fund to address the UN's sustainable development goals, and highlight Israel's catalytic role as what the Prime Minister has called a "climate innovation nation." When Israel helps finance green projects and pipeline development through building liquidity and expertise in its own capital markets, it reaps the benefits of both financial and technological industry leadership as it develops, field-tests, and amplifies those high-value technologies for export.¹⁷

A Diversified Energy Portfolio May Produce Greener Net-Zero Transition Outcomes

As we heard repeatedly from Glasgow, it's all about how to finance energy transitions. How can we carve channels of capital to finance climate transition and impact emission reductions? In short, we must make our money matter. Another challenge facing us here at home is how to deliver cuts in greenhouse gas emissions and at the same time deliver

¹⁶ *The Economist* (2021), "A Wave of Green Government Bonds Is Flooding the Market," October 9

¹⁷ Adelina Barbalau and Frederica Zeni (2021), "The Optimal Design of Green Securities," Imperial College London Business School working paper.

economic incentives for our citizens, our neighbors, our partners, and future partners so we can change behavior and decarbonize in the transition time we have left.¹⁸

Success requires more planning, immediately. We need to laser-focus on both industrial policy and market strategy if we are going to accelerate emissions reduction and sustainable economic growth at home and across the region. We need to direct that focus as well on extending green, clean, and agricultural technologies to other aspiring startup nations that, like us, are striving to move into the mainstream global economy, and that need these technologies now.

A diversified energy portfolio strategy that includes natural gas development will likely prove a better strategy than one focused on renewables only.¹⁹ No less an authority than the International Energy Association (IEA) recognizes the importance of optimizing natural gas with renewables as one element of a strategy to transition to net-zero in the two pivotal decades ahead.²⁰ And although recent research raises some questions about the efficacy of blue hydrogen, is also developing blue, green and white hydrogen technology, which transforms methane from natural gas, ammonia, and water from renewable energy or other sources into clean hydrogen and energy storage.²¹

If we launch the ICF as a permanent capital vehicle that includes new strategic climate investment, we can largely fund and self-finance our energy transition by optimizing the short- to medium-term development of our gas reserves to fuel the larger and longer-term regional energy transition that includes rapid deployment of carbon sequestration and storage technologies.²²

¹⁸ D. G. Victor et al. (2019), "Accelerating the Low-Carbon Transition: The Case for Stronger, More Targeted, International Action," Brookings Institution.

¹⁹ Vincent Xia (2019), "Why 100% Renewable Energy Doesn't Mean Zero Carbon," *Stanford Earth Matters*; UN Economic Commission for Europe (2020), "Pathways to Sustainable Energy: Accelerating Energy Transition."

²⁰ International Energy Agency (2021), "Financing Clean Energy Transitions in Emerging and Developing Economies"; see also IEA (2021), "Total Energy Supply Outlook by Fuel and Scenario 2000–2040."

²¹ *Bloomberg* (2020), "Hydrogen Energy Outlook," March 30; R. W. Howarth and M. Z. Jacobson (2021), "How green is blue hydrogen?" *Energy Science and Engineering*, 9:10: 1676-1687.

²² See for example: Stanford Precourt Institute for Energy (2020), "An Action Plan for Carbon Capture and Storage in California: Opportunities, Challenges and Solutions, Energy Futures Initiative," Stanford Earth-Center for Carbon Storage; Jennifer Morris, et.al. (2021), "Scenarios for Deployment of Carbon Capture and Storage in the Power Sector in a Portfolio of Mitigation Options," *Climate Change Economics*, 12/1, 215001.

The larger region has sufficient natural gas reserves to help fund broader cooperation on the growing energy needs of coastal states. The various SWFs—in Egypt, Cyprus, Greece, Jordan, as well as ours and the Palestinian Investment Fund—could monetize natural surplus and reserves via Egypt’s LNG facilities, and they could finance technologies that promote low-carbon energy production for electrification even as they expand technologies in renewable energy and cogeneration, thereby reducing carbon transition risk. They could engage in programs that affect electricity generation and transition costs, and address energy reliability by reducing intermittency. A recent example of the promise of such interregional initiatives is the water-for-energy pact between Israel, Jordan, and the United Arab Emirates, providing Jordan with 200 million cubic meters of desalinated water in exchange for 600 megawatts of solar generating capacity electricity by 2026.

Regional SWFs could invest in the replacement of coal and diesel without causing carbon lock-in that might limit investment in renewables. It goes without saying that immediately halting coal imports domestically and regionally, and accelerating near-term gas utilization will not only improve air quality but also enable faster adaption of cleaner energy systems later because it will help us avoid the destabilization of power grids from overuse once flexible generation and energy storage become widely commercially viable and available.

Halting coal and accelerating near-term use of natural gas would also: (1) eliminate the risk of stranded assets because we would be depleting reserves sooner at higher prices; (2) increase sovereign wealth fund revenues that can be invested in energy systems and hybrid technologies, (3) thereby increasing revenues and economic growth in the region through increased exports.

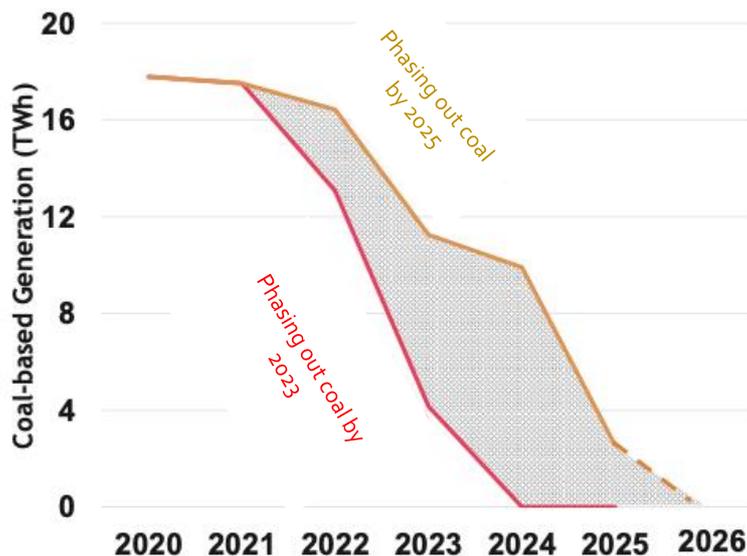
Recent research indicates that Israel could phase out coal energy production and related emissions completely by the end of 2023 instead of the end of 2025 by accelerating parallel processing gas conversion of two coal plants for two years consecutively instead of serially converting the four remaining coal plants over for four years. As Figure 5²³ suggests, this could simultaneously :

- accelerate its phase out of coal usage in electricity (still at 24%) by the end of 2023;
- yield net carbon emissions reduction of 9 million tons;

²³ Chen Herzog, Natural Gas Export Policy in the Wake of COP 26, BDO-Israel, November 2021

- reduce electrical generation costs by 4 billion NIS; and
- increase the Government take from increased gas revenues into high-yielding climate technology innovation that can address social and welfare needs as defined by the ICF.

Figure 5: Different Paths to Phasing Out Coal in Israel: 2023 versus 2025



Source: Herzog, November 2021.

Carbon emissions from coal have increased exponentially by non-OECD emerging and developing economies, but if we can increase natural gas exports, this will enable Jordan and Egypt and other North African countries to reduce dependence on their higher-emission fuels (coal and fuel oil) without crowding out increased renewable production over the next two critical decades. This requires translating technology transfer and marginal cost abatement analyses by advancing inter-regional trade policy to fuel carbon emission reductions.

We can use our major natural gas assets in low-carbon gas, hydrogen, and renewable projects to both decarbonize and avoid the loss of stranded assets. We can retrofit gas transportation technology to transport pure hydrogen, once supply and demand increase. We can fit carbon capture and storage (CCS) units to existing methane reformers in heavy industrial sites like refineries, petrochemical, and re-/ upcycling waste-to-energy plants, and steel and aluminum smelters. Zero-emitting hydrogen could ultimately replace natural gas in production processes. IT solutions to tracking, tracing, and mitigating methane leakage across entire

industrial value chains—including production, transport, storage, and end use—is a clear target for collaboration and application.²⁴

Israel should pursue constructing its energy transition portfolio and an ICF investment portfolio aligned to reduce carbon footprints over time while keeping domestic economic growth alive. Specifically, these actions would enable Israel to accelerate needed investments in:

- **crop engineering** (to enable storing more carbon in roots, with no tillage cultivation) and accelerating distribution of high-value technologies for climate-smart agriculture.
- **electricity production.** Installed capacity of wind and solar are soaring, but investment in new technology is flat. Electricity storage technology needs to be highly improved, and there are promising avenues for this in Israel. Renewables alone will not get us through to decarbonization. Flexible gas-fired power plants that capture carbon emissions, and carbon storage and sequestration throughout industrial and energy supply chains will keep electricity grids and those supply chains resilient and reliable as they shift to renewables and alternative fuels.
- **the built environment,** through advanced heat pump technology and electrification of HVAC systems; and cutting emissions through monitoring and greening buildings, which are a huge source of emissions, especially in this region of the world.
- **carbon capture, sequestration, and storage,** enabling emissions reductions in industrial and electricity sectors enabling them to decarbonize.
- **renewable energy production and storage.**²⁵

The UK, France, Germany, and some US states are already using the proceeds from cap-and-trade programs, carbon taxes, and sovereign wealth funds to deploy clean technologies. Following their examples, Israel can monetize revenue streams into the ICF. With our Eastern Mediterranean neighbors, we can use that generated revenue from natural gas and other natural resources to finance new energy systems, improve performance, and reconfigure and shape new markets. Through these investments, we can build a sustainable national and a regionally integrated economy.

²⁴ Phillip Johnsson, N. Frederik, and S. Elin, (2020) “Marginal Abatement Cost Curve of Industrial CO2 Capture and Storage—A Swedish Case Study, *Frontiers in Energy Research*, 8.

²⁵ At great example of the virtuous circle of energy, transition financing is to consider Israel’s bromine resource. Bromine extraction could pay taxes to the ICF, which could fund further expansion of an emerging Israeli competitive advantage in commercializing new science of zinc-bromine batteries for grid-scale storage of renewable energy.



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