



Israel and East MED Natural Gas Development

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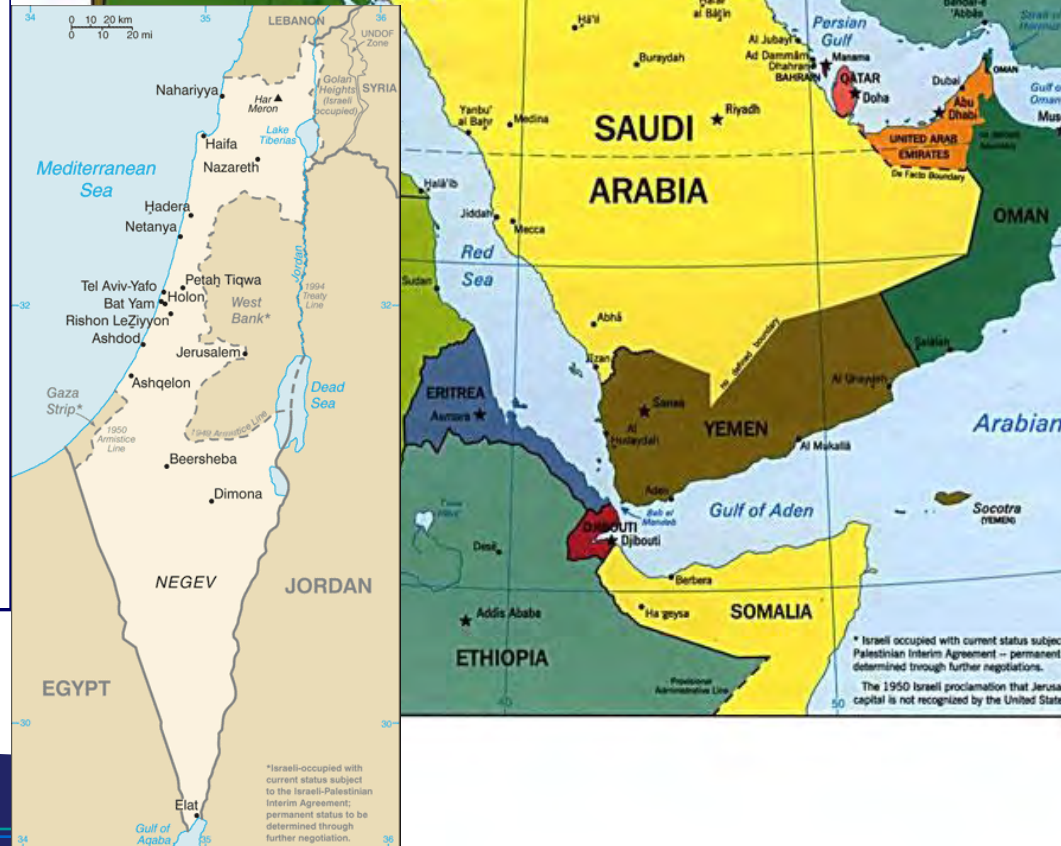


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Israel

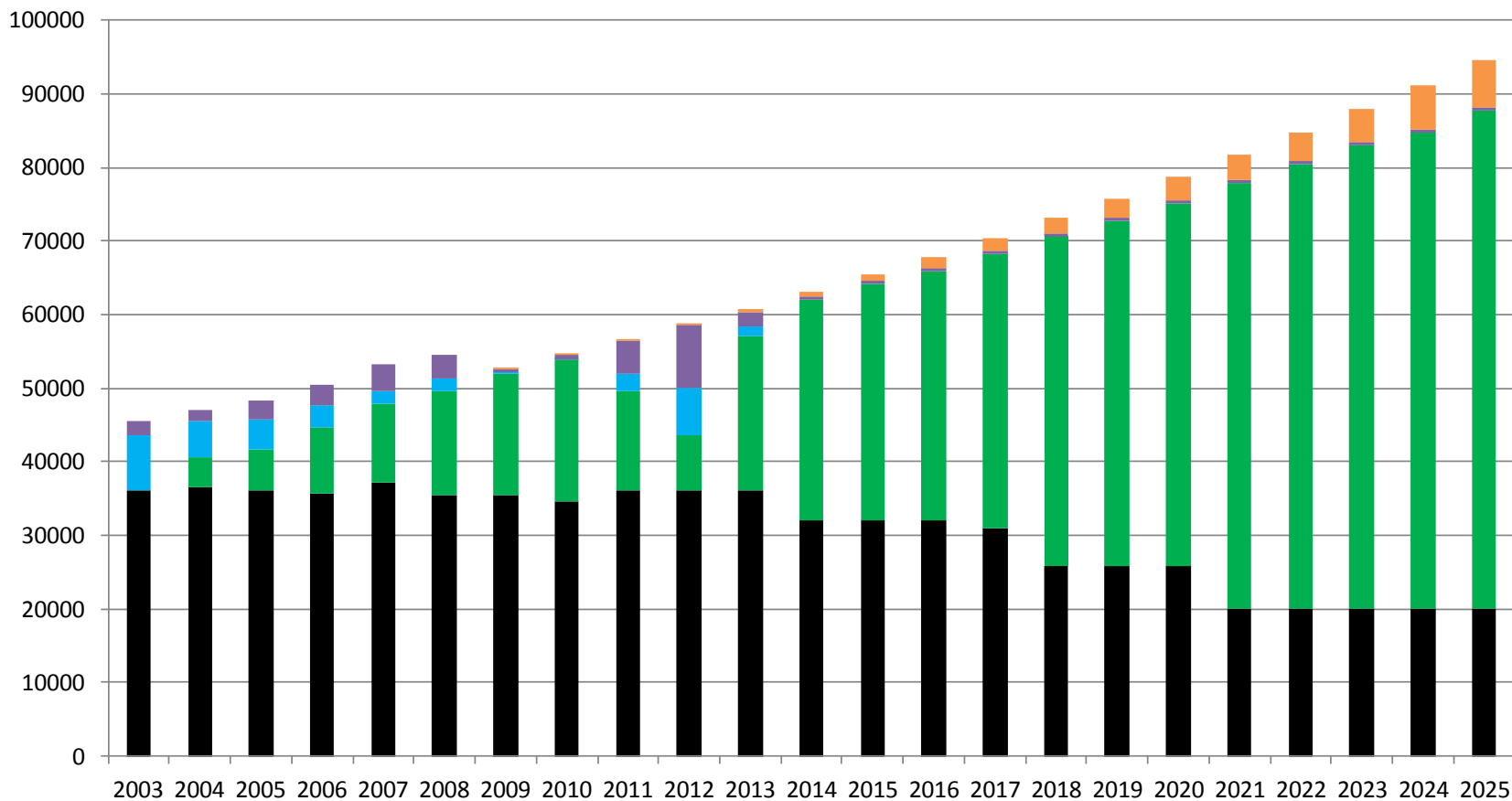
country facts (2015)

- Area – 22,000 sq km
- Population – 8.3 million
- GDP – \$270 billion
- GDP/capita - \$33,000
- GDP growth rate – 2.8%
- Investment in R&D – 4.2% of GDP – the highest rate in the world)
- Energy consumption – 25 MTOE
- Installed power capacity –17 GW



Electricity Demand Forecast by type of Fuel

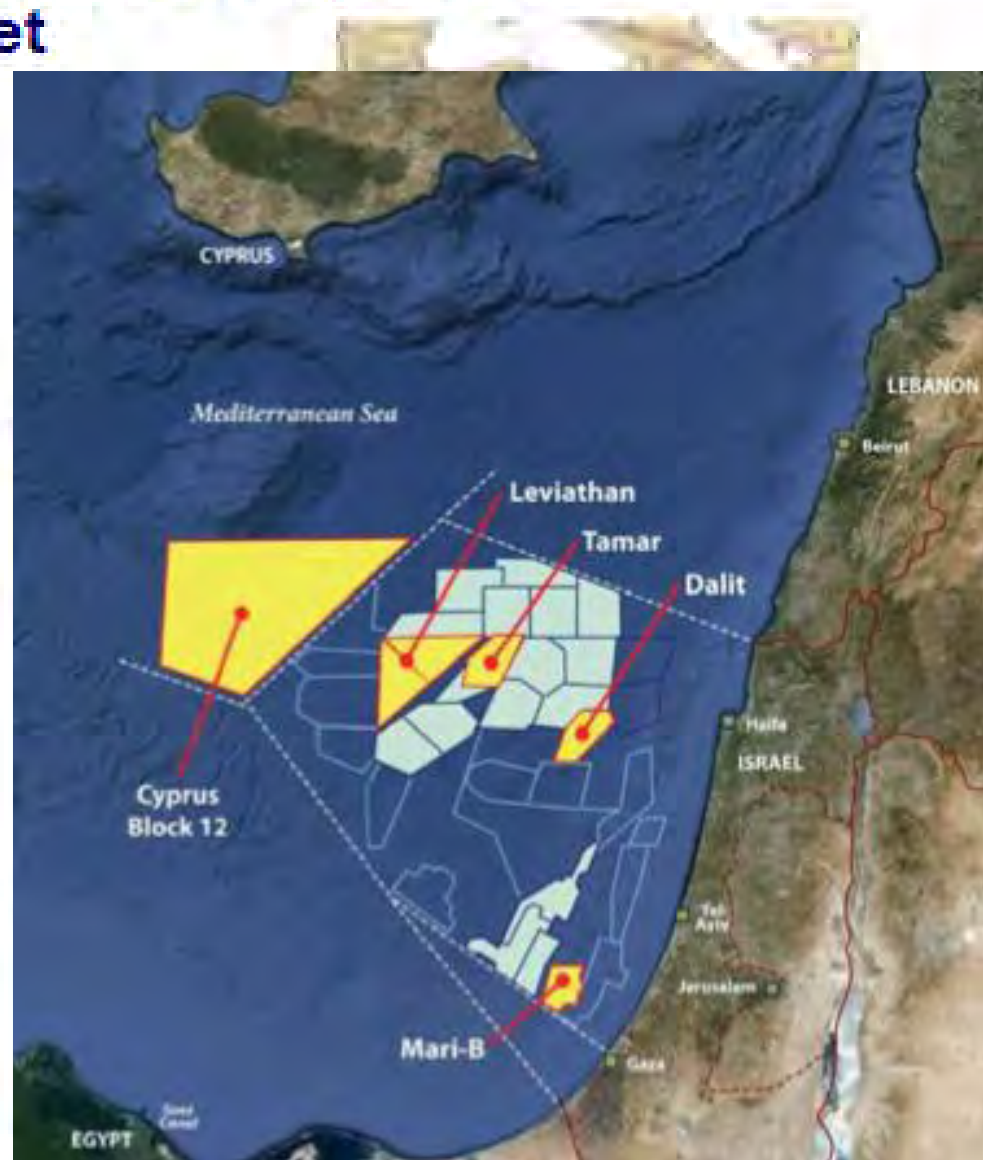
2003-2025, Million KWh



Source: Eco Energy ■ Coal ■ Natural gas ■ Heavy fuel oil ■ Gasoil ■ Renewables

Significant recent natural gas discoveries offshore Israel by Noble Energy and its Israeli partners totaling **35 trillion cubic feet**

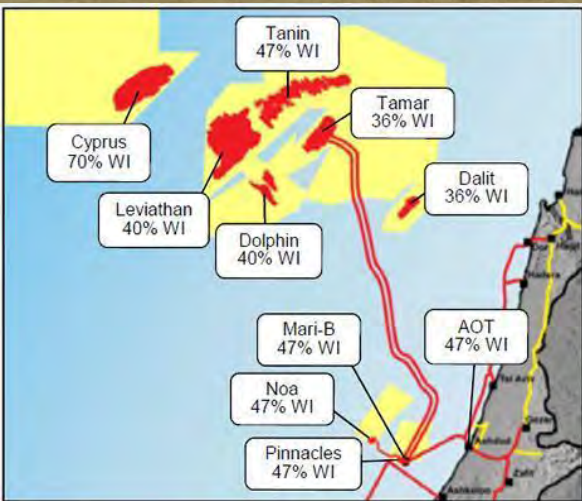
- ▶ Noble Energy came to Israel in the late '90s
- ▶ Noa discovered in 1999, Mari-B in 2000
- ▶ Andromeda drilled in 2001, Hanna in 2003, each dry holes
- ▶ Acquired more permits and licenses in 2006-2008, conducted additional seismic surveys
- ▶ Tamar and Dalit discovered in 2009
- ▶ Leviathan discovered in 2010
- ▶ Leviathan appraisal, Tamar development drilling, continued exploration in 2011



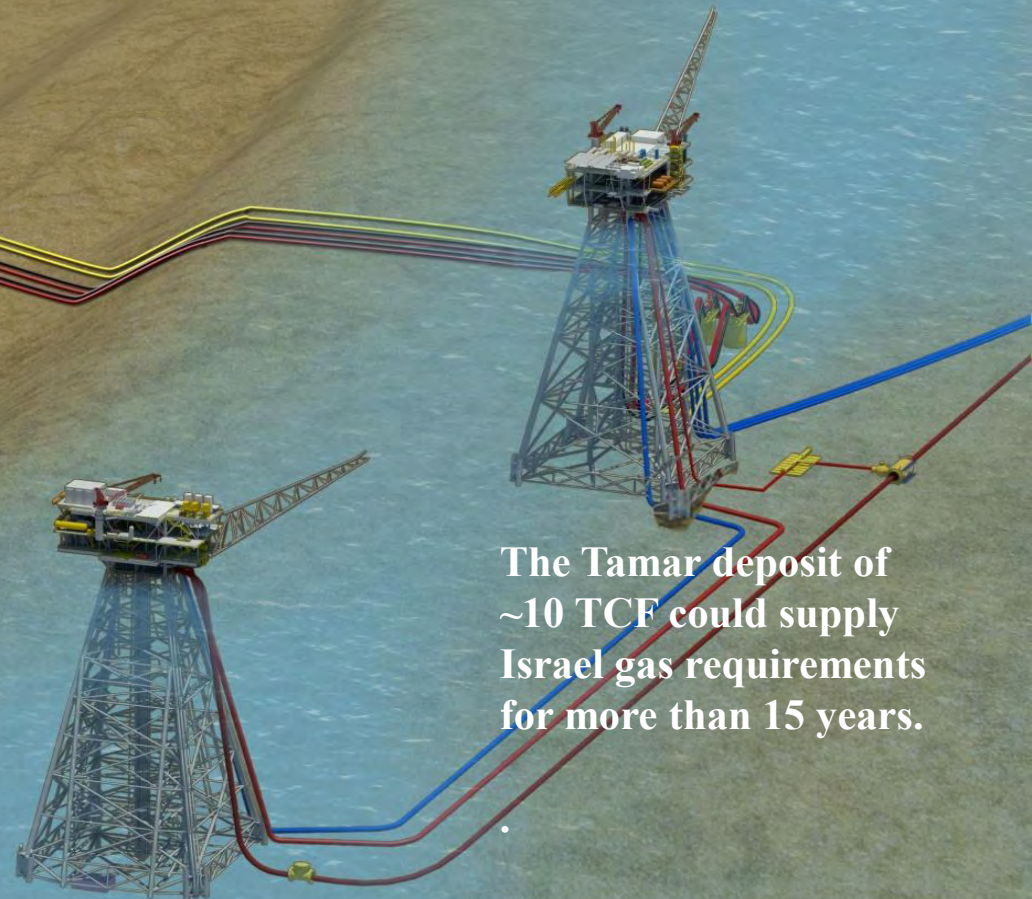
The Tamar Project



Technical Strategic & Security Risks



- Drill 5 wells to ~ 5000 m
- Install subsea development @ 1700 m
- Install 150 km of dual 16" pipelines
- Build and transport Tamar platform
- Install Tamar platform near Mari-B



The Tamar deposit of ~10 TCF could supply Israel gas requirements for more than 15 years.

Leviathan field – 22 TCF, 2020?





Pipeline to Turkey

Pipeline to Greece



Vassilikos Energy Centre



East Med Gas Export Options



Egypt LNG (existing)



SEGAS LNG (existing)

ISRAEL



LNG plant in Israel

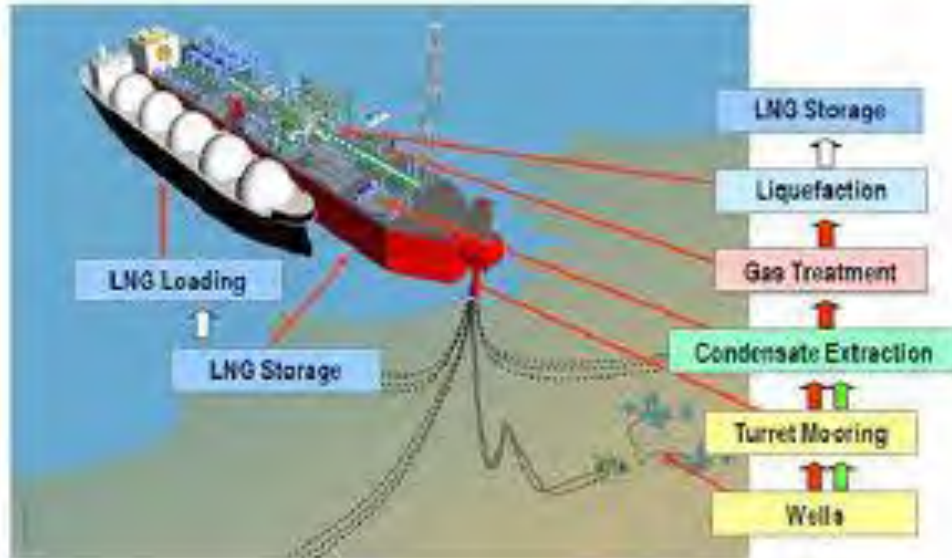
JORDAN

Aqaba Free

April 2015



Floating LNG





Our long term vision is to use natural gas, renewable and nuclear energy for power generation to fuel the world's Auto fleet – run on gas, charge batteries and produce hydrogen for transportation

The Clean Transportation Vision



Natural gas & renewable energy to enhance energy and environmental security

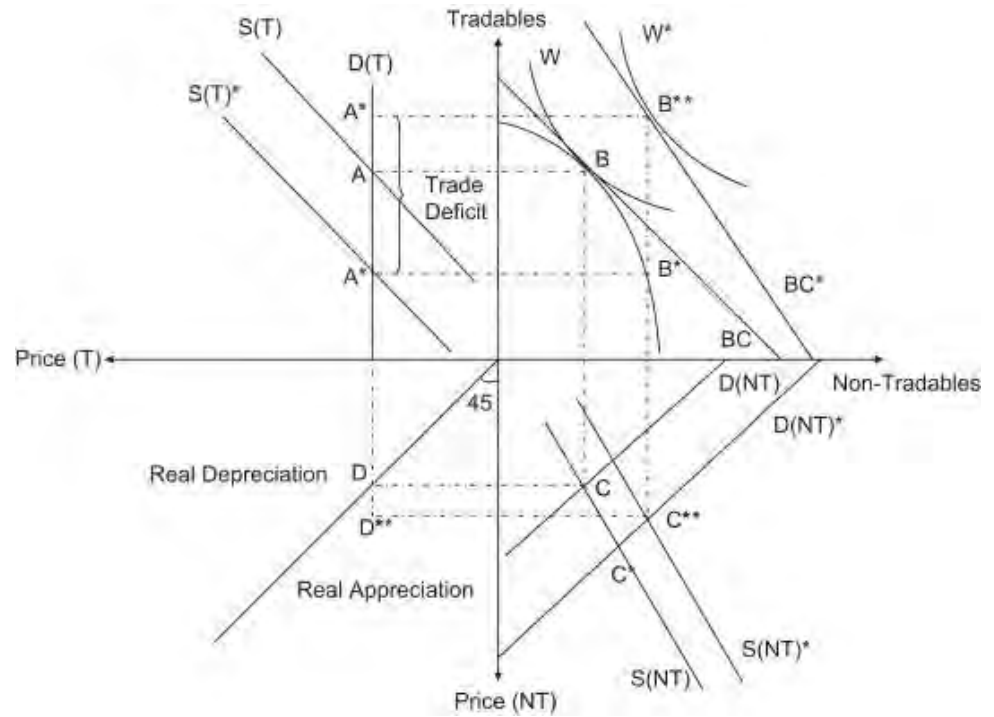


Thank You

Environmental risks NIMBY & BANANA



The Dutch Disease



IEI Oil Shale in-situ technology



- Reserves of 400 billion tons of oil shales
- Containing ~250 billion Barrels of oil
- Technology is being developed by IEI



Renewable Energy

- 8% of world energy consumption (90% of which is hydro)
- Expected to grow to ~12% by 2035



The Luz II / Brightsource demonstration power tower in southern Israel



Luz and its successor Soledad
Solar thermal power plants



In the 1980s Israel's Luz commissioned a 352 MW thermal solar plant in the Mojave desert, CA



Zenith Solar concentrating photovoltaic technology



Aora solar thermal tower

Solar thermal water heating

95% utilization in house holds,
Mandatory in Israel since 1980



David Ben Gurion



Prof.
Zvi Tavor



שנחאי פודונג הישנה - 1984



שנחאי - 2014



Natural Gas Infrastructure Transmission System



Source: Ministry of Energy & Water

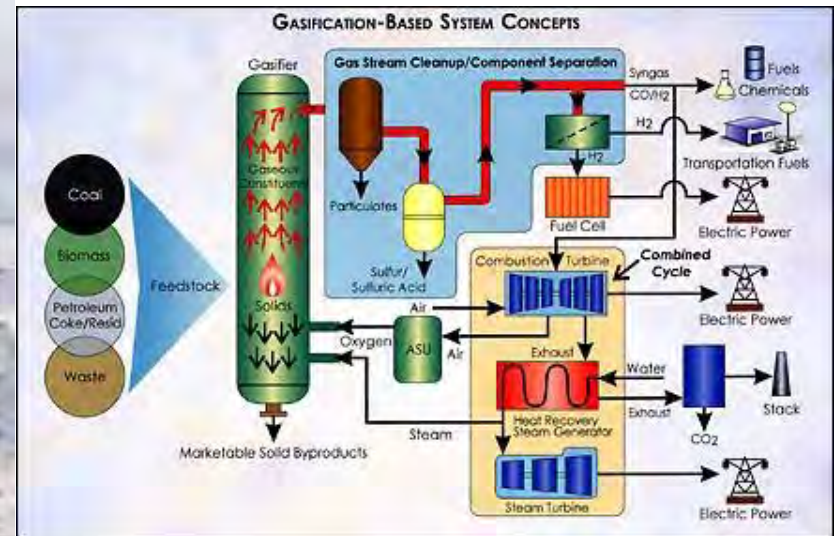
Natural Gas to Liquids (GTL)



Figure 3 - Typical LNG import Gravity Base Structure (GBS)
Source: Shell G&P Website



Coal to Liquids (CTL)



Natural Gas

- The “fuel of choice” for power generation and industrial utilization
- Much cleaner than oil and coal
- Abandoned reserves

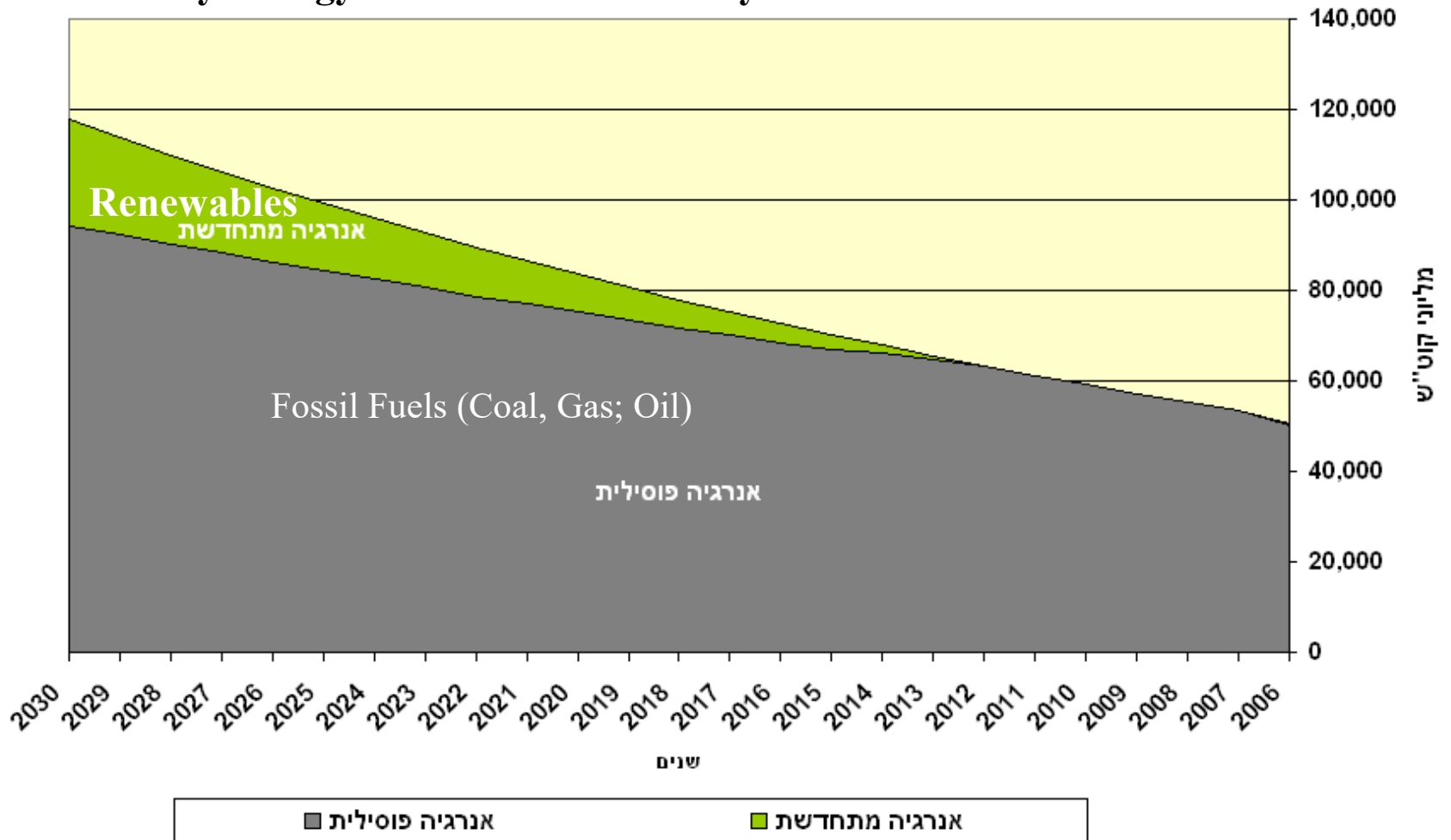


Figure 3 - Typical LNG import Gravity Base Structure (GBS)
Source: Shell G&P Website



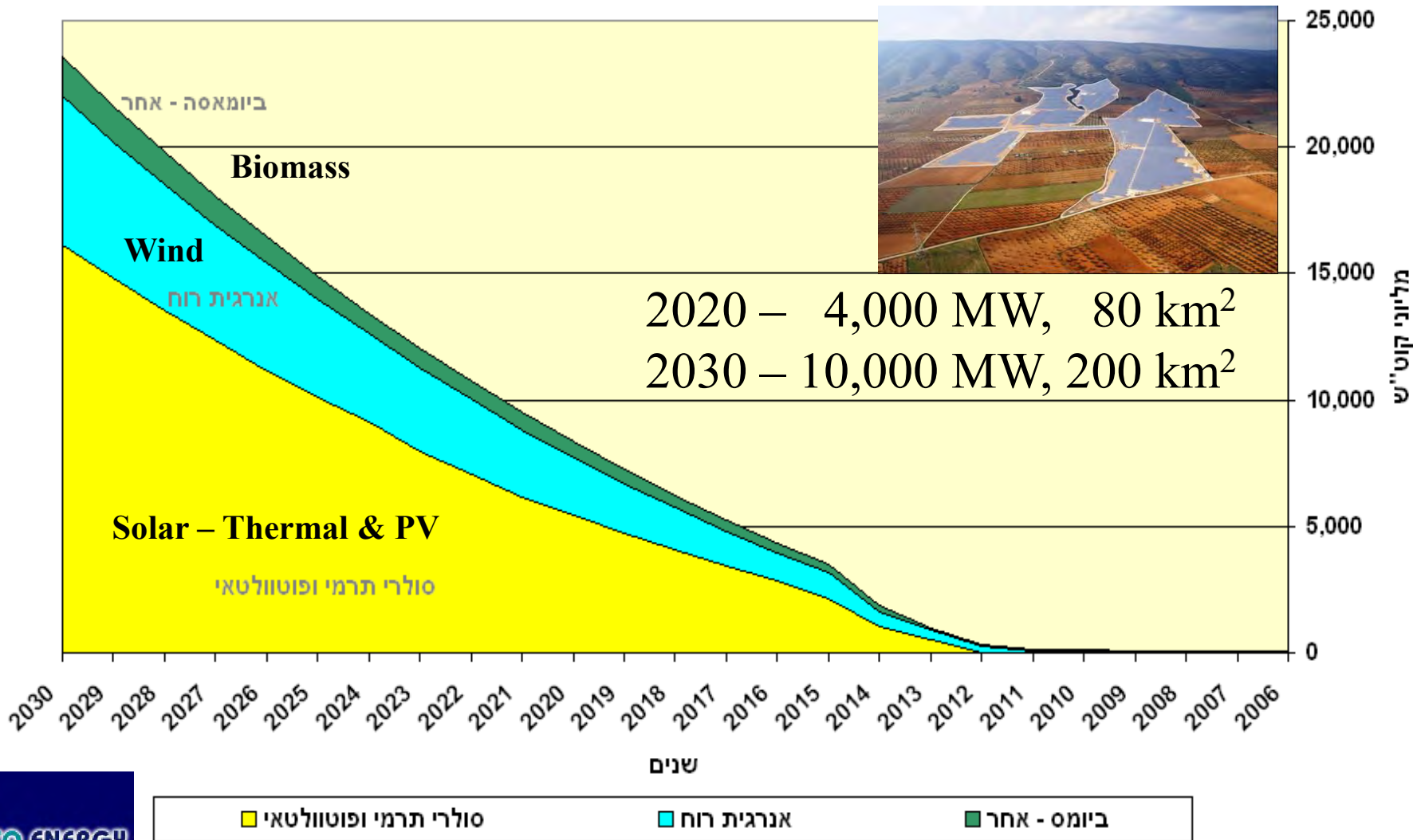
תחזית מקורות אנרגיה ליצור חשמל בישראל, 2008 - 2030

Primary Energy Sources for Electricity Production in Israel: 2008-2030



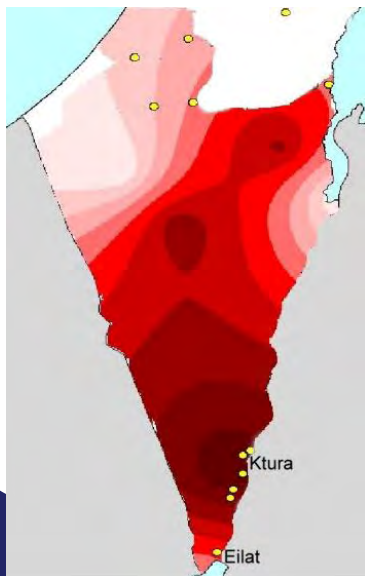
Israel: Renewable Energy Penetration Forecast 2009-2030

Million KWh (Implications of GOI objectives)



Net benefits of large scale utilization of Renewable energy in Israel

US\$ 3 Billion

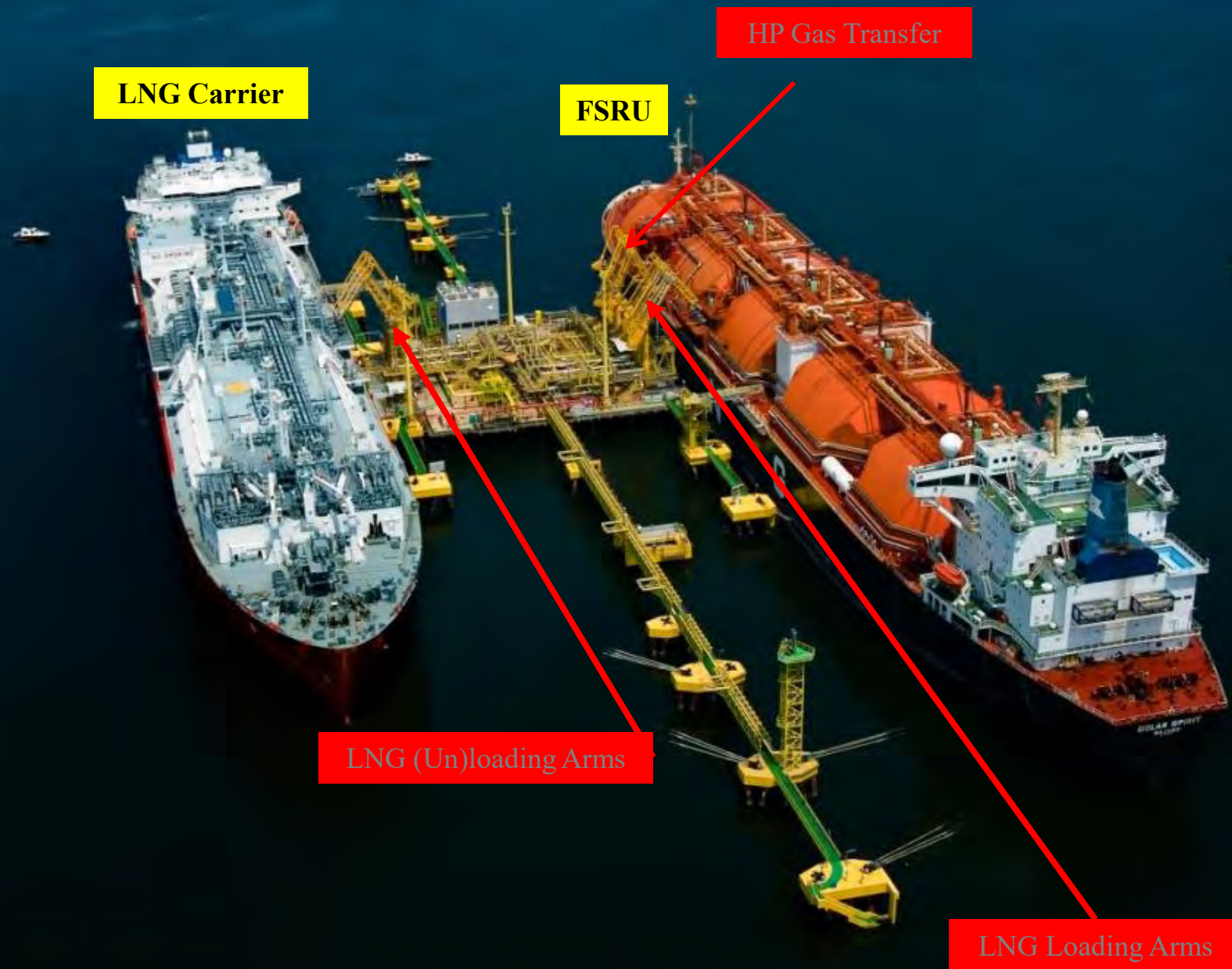


		Appendix reference	NPV 7%	Annually Levelised
Benefits				
Direct benefits				
	\$10/ton CO ₂	A1	425.4	40.2
Avoided environmental costs	\$20/ton CO ₂		709.0	66.9
Stable and known energy prices		A2	70.7	6.7
Avoided transmission & distribution (T&D) costs		A3	116.1	11.0
Avoided fuel costs		A4	171.5	16.2
Real options value for T&D investments		A5	2.3	0.2
Total direct benefits	\$10/ton CO ₂		786.0	74.2
	\$20/ton CO ₂		1,071.8	101.2
Indirect benefits				
Income multiplier: Thermal technologies		A6	1,179.5	94.6
Income multiplier: PV technologies		A7	551.0	44.2
Avoided unemployment compensation: Thermal technologies		A6	234.2	18.8
Avoided unemployment compensation: PV technologies		A7	134.5	10.8
Total indirect benefits			2,099.2	168.4
Total benefits		\$10/ton CO ₂	2,885.2	242.6
		\$20/ton CO ₂	3,171.0	269.6
Costs				
Additional generation costs		A8	962.1	77.2
Environmental costs		A9	25.3	2.0
Fuel switch to solar heating/cooling		A10	126.6	10.2
Total costs			1,114.0	89.4
Total net benefits – 7% discount rate		\$10/ton CO ₂	1,771.2	153.2
		\$20/ton CO ₂	2,057.0	180.2
Total net benefits – 5% discount rate		\$10/ton CO ₂	2,713.0	205.7
		\$20/ton CO ₂	3,184.3	243.5

STATE OF MICHIGAN
MICHIGAN POWER SYSTEM
MICHIGAN POWER SYSTEM
MICHIGAN POWER SYSTEM



1st Conversion – Golar Spirit (Brazil) – 2 MTA



LNG Carrier

FSRU

HP Gas Transfer

LNG (Un)loading Arms

LNG Loading Arms

Other Natural gas export options

