

Section II

Iran's Nuclear Fuel

Cycle Facilities:

The Myths of Self Sufficiency and Maximizing Energy Resources





• Why Iran's Large Nuclear Fuel Cycle Investment Makes No Sense Economically

- **Alternate investments** in natural gas or oil refining would be more attractive.
- Iran **lacks adequate deposits of natural uranium** to be self sufficient for civil nuclear power.
- Iran's supply of other **energy resources far from depleted.**



Estimated Fuel Cycle Costs

Capital costs of selected nuclear facilities (Arak, Esfahan, Saghand, Gchine, Natanz) **approximately \$600 million - \$1 billion.**

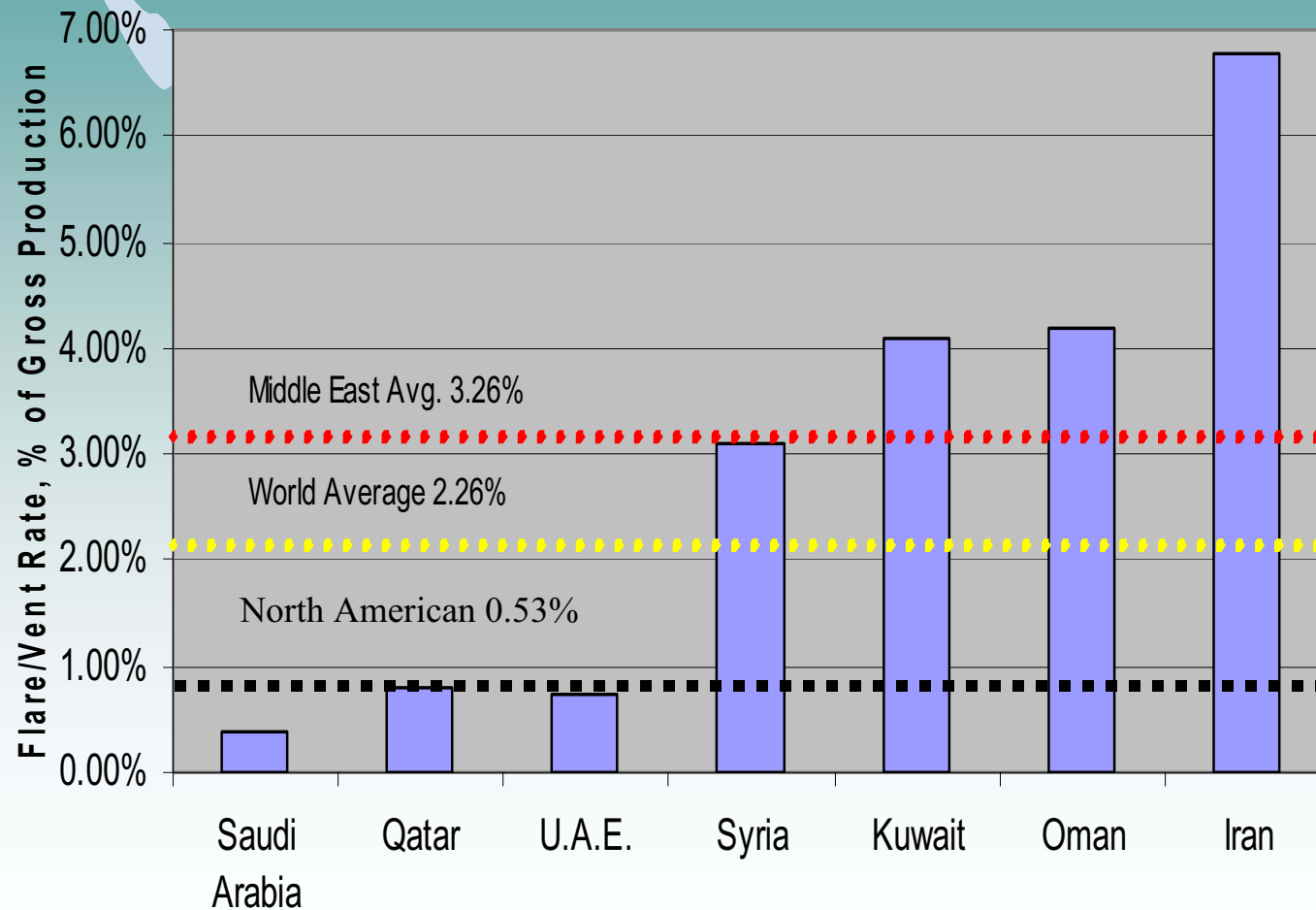
For seven planned reactors, Iran would need to invest **at least another \$6.0 billion.**

- The role of economies of scale not clear in the Iranian nuclear program.
- Additional developmental hurdles unclear, such as with the fuel fabrication plant.

Attractive Alternatives to Investing in the Nuclear Fuel Cycle

- If Iran invested \$2.5 – \$3.2 billion to upgrade its natural gas infrastructure rather than to construct a nuclear fuel cycle infrastructure, **Iran could save, at current market prices, \$1.6 – \$2.2 billion worth of natural gas annually.**
- Were Iran to invest \$5.5 billion in oil refinery projects to upgrade its gasoline refinery capacity, **Iran could increase the annual net revenue for its petrochemical sector \$982 million.**

Alternative Investment Example: Recovering Natural Gas



Data from U.S. EIA International Energy Annual 2002, Table 4.1, Photo from World Bank.



Benefit of Recovering Wasted Gas

In 2002, Iran wasted 6.78% of natural gas gross production equal to 290 billion ft³.

- Assume Iran moved to world average (2.26%)
 - Approximate investment = \$2.5 billion
 - Savings equivalent to:
 - \$1.6 billion (Market price 7.78\$/MMBtu)³
 - 2.8 Bushehr Nuclear Power Plant equivalents⁴
- Assume Iran moved to N. American Average (0.53%)
 - Approximate investment = \$3.2 billion
 - Savings equivalent to:
 - \$2.22 billion (Market price 7.78\$/MMBtu)³
 - 3.9 Bushehr Nuclear Power Plant equivalents⁴

1,2 – Data From U.S. EIA International Energy Annual 2002, Table 4.1

3 – Market Price U.S. EIA Natural Gas Weekly Update 7/13/05

4 – Replacement for CCTG Plants - 7200 BTU/kw-hr heat rate, 85% capacity factor, 1070BTU/ft³ natural gas

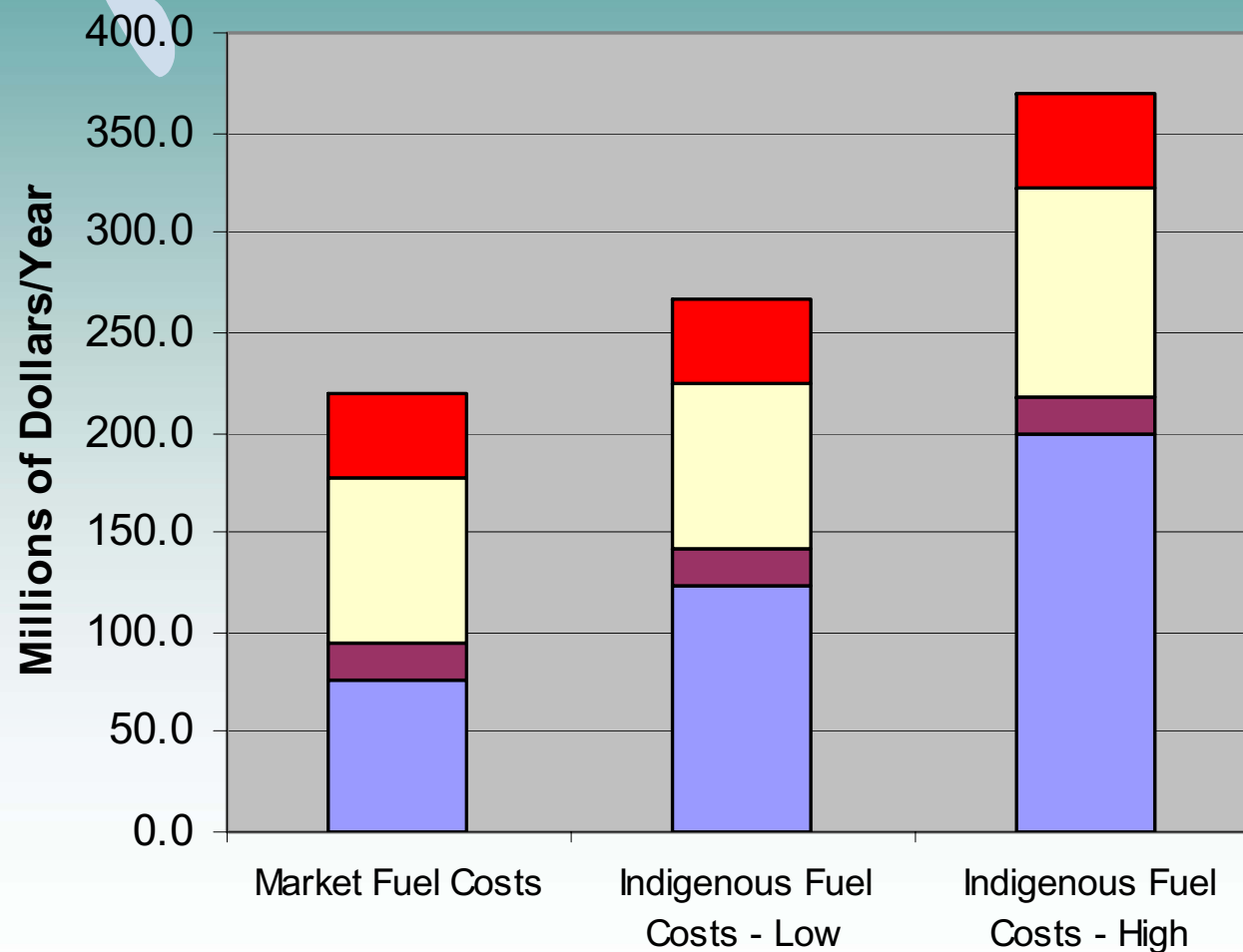
Alternative Investment Example: Reducing Gasoline Imports

- In 2001, Iran was importing 8.5 million liters of gasoline per day
- In 2004, Iran was importing 40% of their daily gasoline needs, or 22 million liters of gasoline per day¹ valued at **\$2.5 – \$3.0 billion²**.
- Annual demand increasing at around 9% per year²
- Gasoline imports could potentially cost **Iran \$4.5 billion for 2005³**

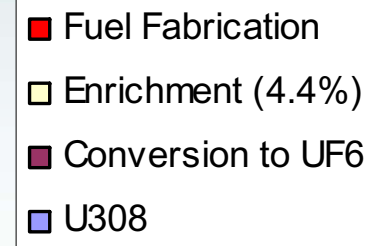
Benefits of Gasoline Production Upgrade

- If Iran were to invest \$5.6 billion in a **high gasoline yield Western-type refinery**, it could eliminate its dependence on imported gasoline and increase its annual net oil-related revenue by approximately \$982 million.

Comparative Nuclear Fuel Costs for 7000 Megawatts: Indigenous Vs. Market



- Iran could save \$59 - \$161 million per year by purchasing fuel from abroad.



The Myth of Nuclear Fuel Self Sufficiency

- Setting economics aside, even if speculative uranium deposits in Iran are assumed and included, Iran is not close to possessing sufficient uranium to fuel seven 1000 MWe for their lifetime. **It is thus impossible for Iran to avoid dependence on a foreign supplier for its uranium fuel.**

• Limited Uranium Resources

Iran does not have enough uranium to fuel its planned reactors

- Known uranium (1,427) + speculative (13,850) = 15,277 tons U
- Assume Bushehr burns 22 tons of LEU annually

	Known Uranium	Known + Speculative Uranium
Number of Operational Reactors	Years of Operation	Years of Operation
1	6.5	69.4
2	3.2	34.7
3	2.3	23.2
4	1.6	17.4
5	1.3	13.9
6	1.1	11.6
7	0.9	9.9