

Macroeconomic factors influencing nuclear power deployment in developing countries

INPRO Dialogue Forum on Nuclear Energy Innovations

Vienna, Austria

February 1-4, 2010

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IAEA

International Atomic Energy Agency

Overview

- **Introduction**
- **Key macroeconomic factors**
- **Nuclear investment decision**
- **Nuclear investment impact**
- **Other important considerations**
- **Concluding comments**

Introduction

Definition:

“Macroeconomics involves the study of economy as whole in light of the aggregate factors such as Gross Domestic Product, employment, Balance of Payments, etc.

Key macroeconomic factors

- **Gross Domestic Product**
- **Employment**
- **Balance of Payment**
- **Price Stability and Inflation**
- **Financial Markets and Interest Rate**
- **Cost and Investment**

The Economics of Nuclear

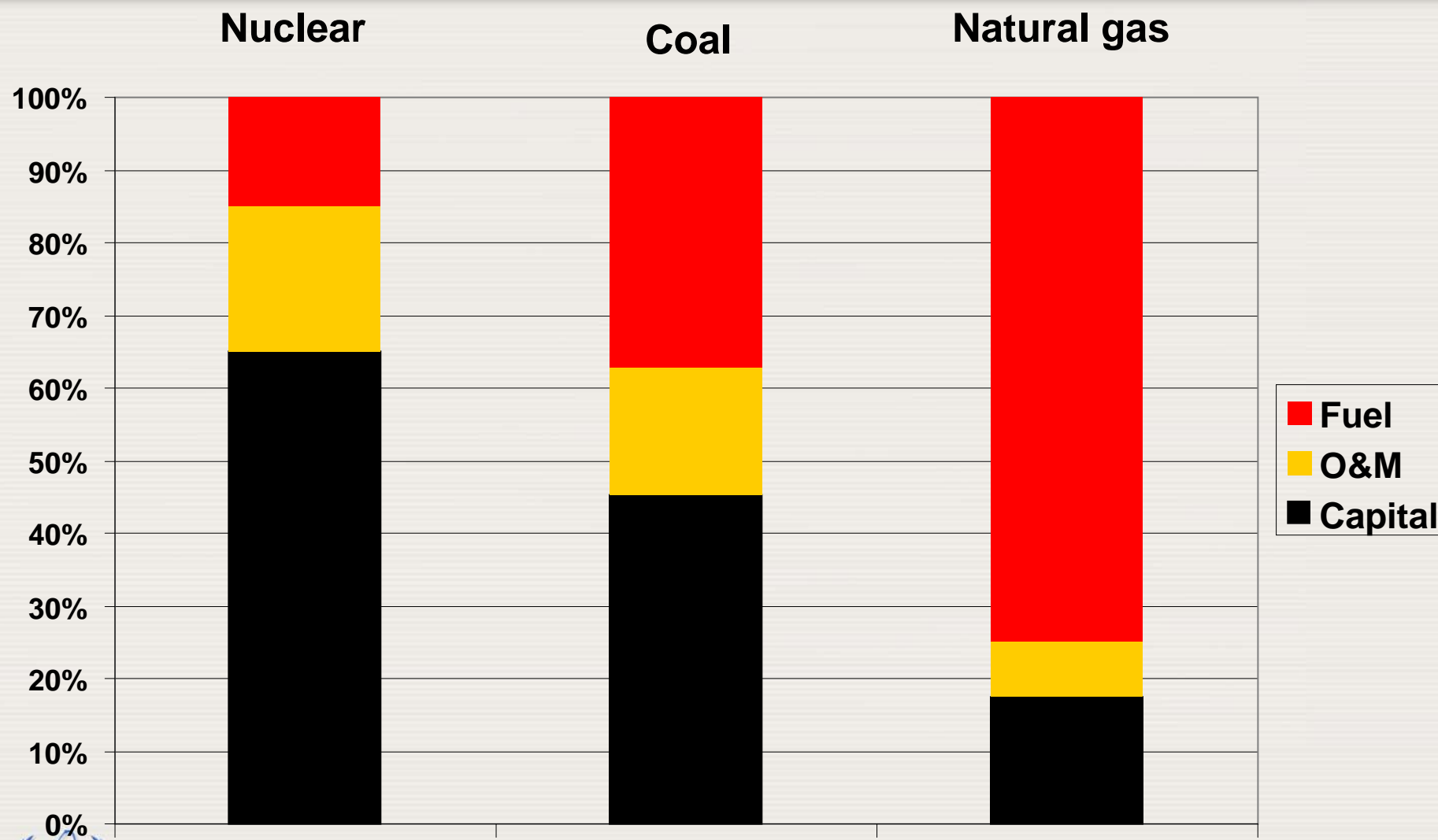
Advantages

- **Nuclear power plants are cheap to operate**
- **Stable & predictable generating costs**
- **Long life time**
- **Supply security (insurance premium)**
- **Low external costs (so far no credit applied)**

But.....

- **High upfront capital costs can be difficult to finance**
- **Sensitive to interest rates**
- **Long lead times (planning, construction, etc)**
- **Long payback periods**
- **Regulatory/policy risks**

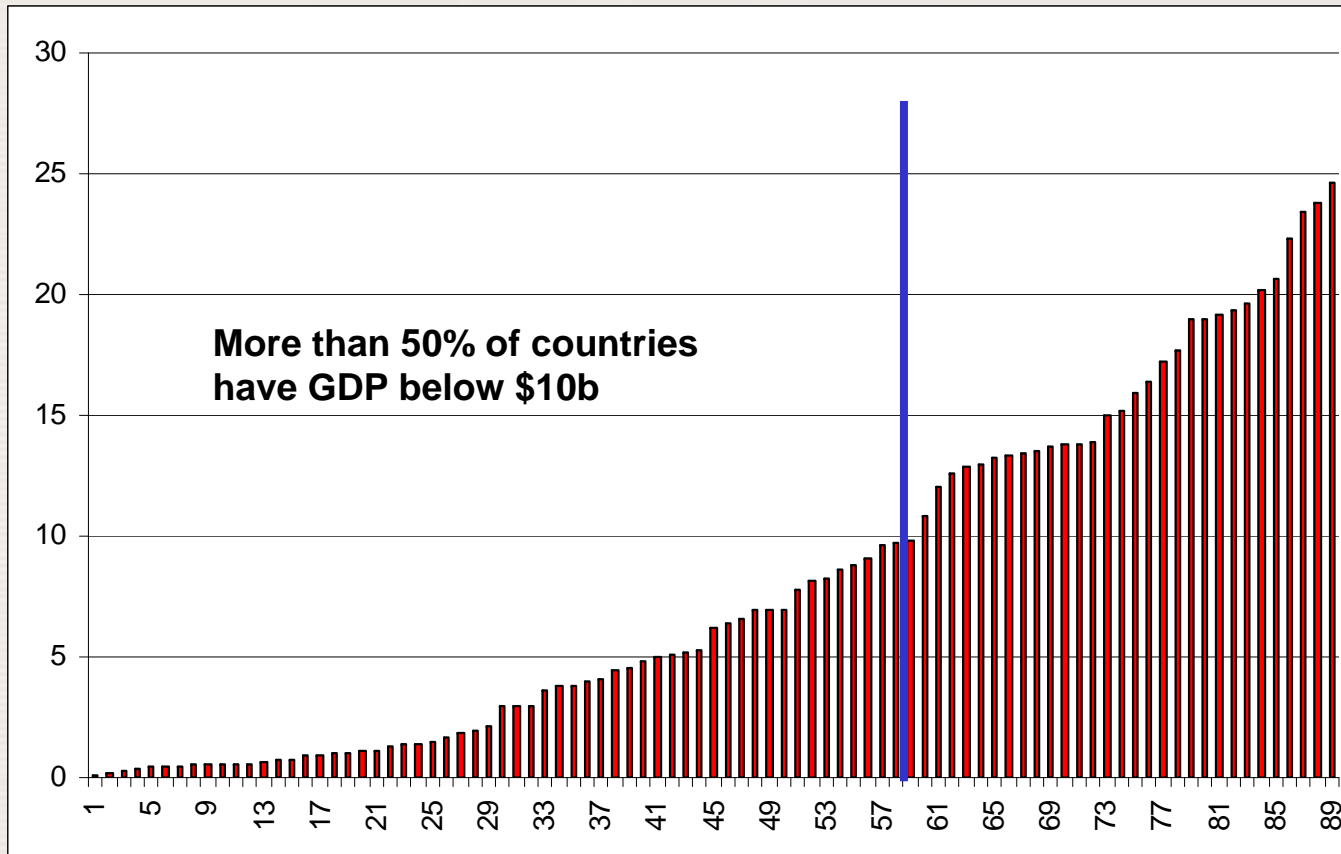
Cost structures of different generating options



Gross Domestic Product and nuclear high up front capital cost

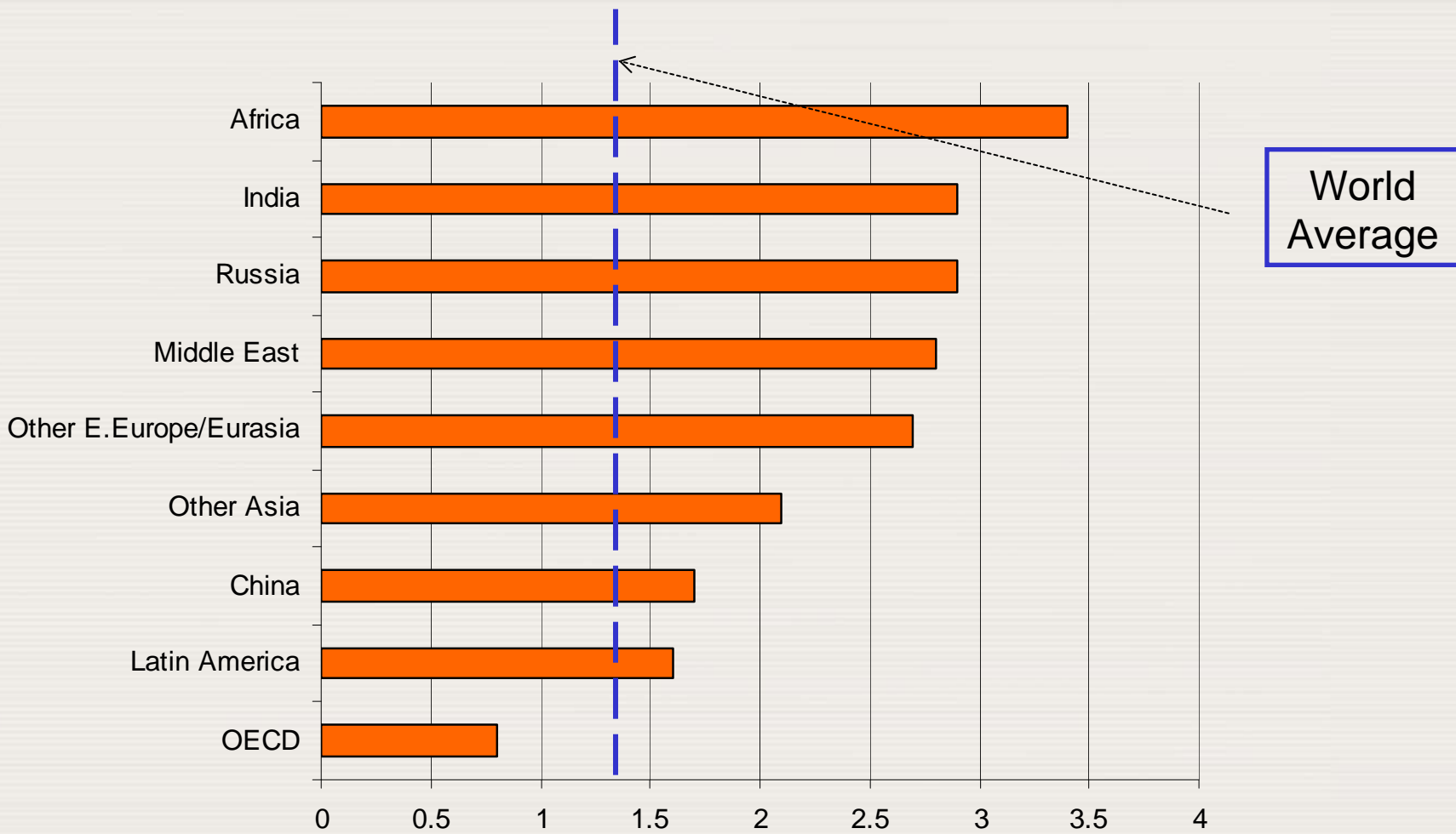
Overnight capital cost quoted for a typical 1000MW nuclear plant range from \$2 - \$6 billion, therefore it is a significant investment commitment

Gross Domestic Product (GDP) in 2008 billions



Source: IMF World Economic Outlook, October 2008

Share of Energy Investment in GDP, by Regions



Financial Infrastructure



**Credit availability:
Local and international**

Liquid financial markets



Financial Infrastructure

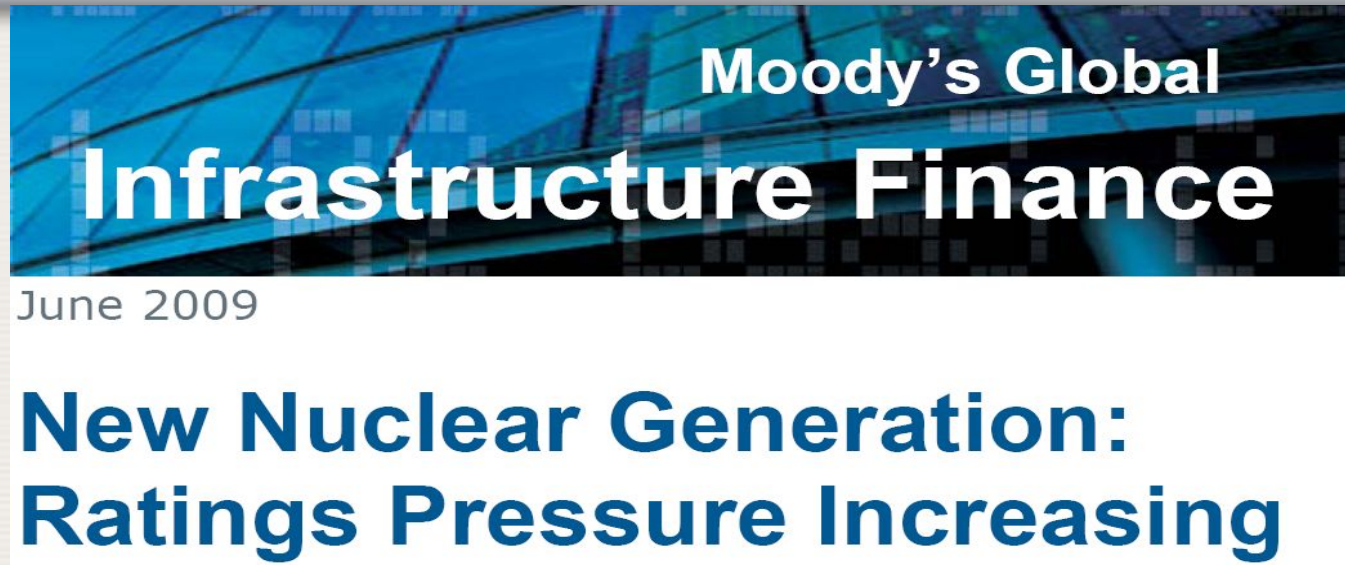


Supportive exchange rate

Low interest rates



Credit Rating



- Moodys' considering taking a more negative view for issuers seeking to build new NNP
- *WHY? Bad history, where utilities suffered rating downgrades; and currently, most utilities seeking to built nuclear generation do not appear to adjust their financial policies, a credit negative*
- **WHAT THEY SEEK?** Partnerships, balance sheet strengthening, increasing liquidity, etc can help utilities maintain their credit rating

Nuclear Investment Decision

Macro factors (inputs)



Influence nuclear decision?

YES!



NO

Increase in productivity/GDP
Employment
Balance of payments
Price Stability
Inflation

Employment

Nuclear investment leads to:

- **Direct employment in construction, operation and nuclear fuel cycle**
- **Indirect employment in support services**

The statistics vary on a country basis based on the size of the project:

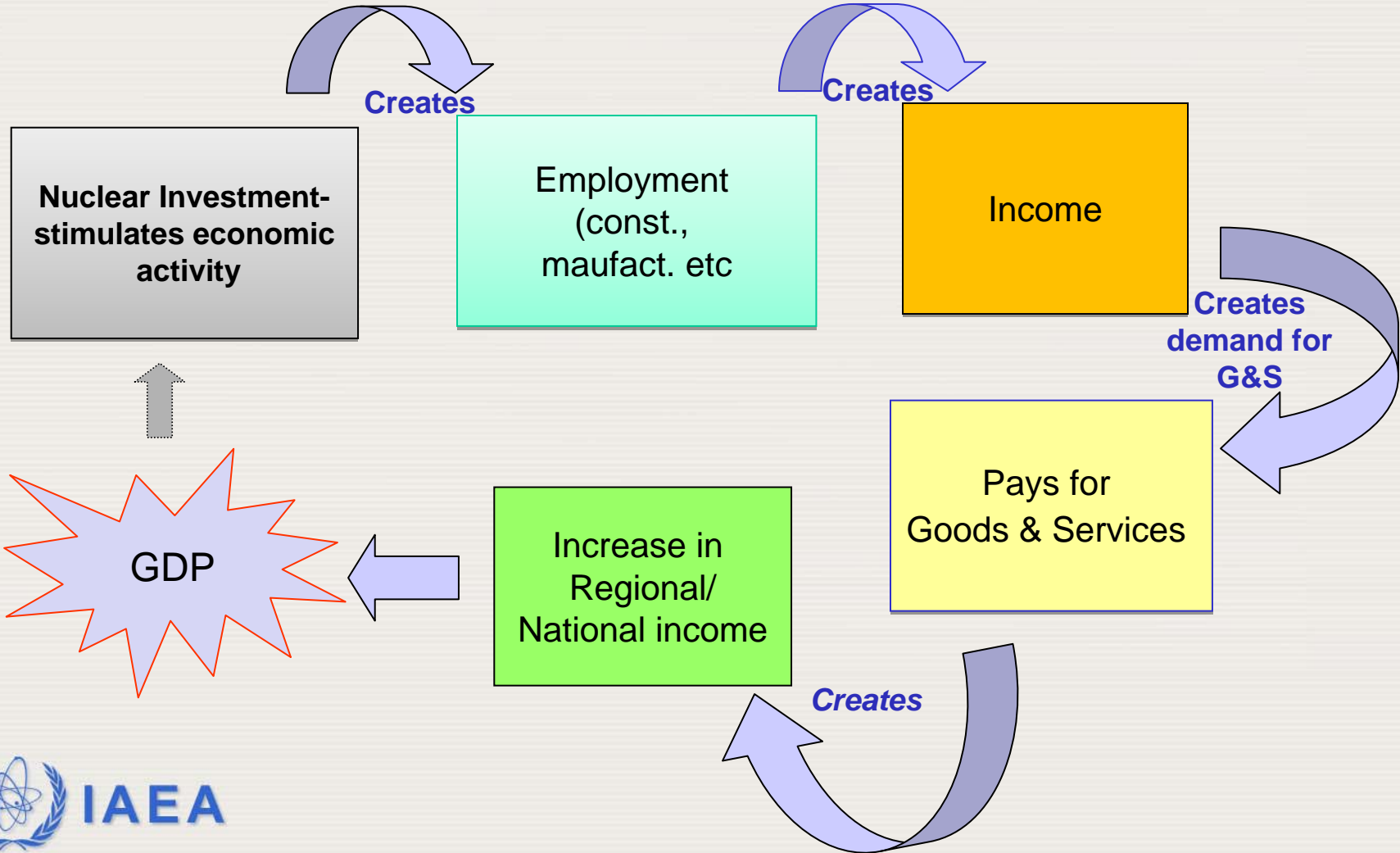
India: 100,000 jobs for the 30 reactors to be completed by 2020 (oneindia, 28 July 2008)

UK: More than 100,000 jobs (18 Sep 2008, Reuters UK)

US: Nuclear energy investment equals 350,000 new jobs (Oxford Economics 2008)

Nuclear Investment and Gross Domestic Product

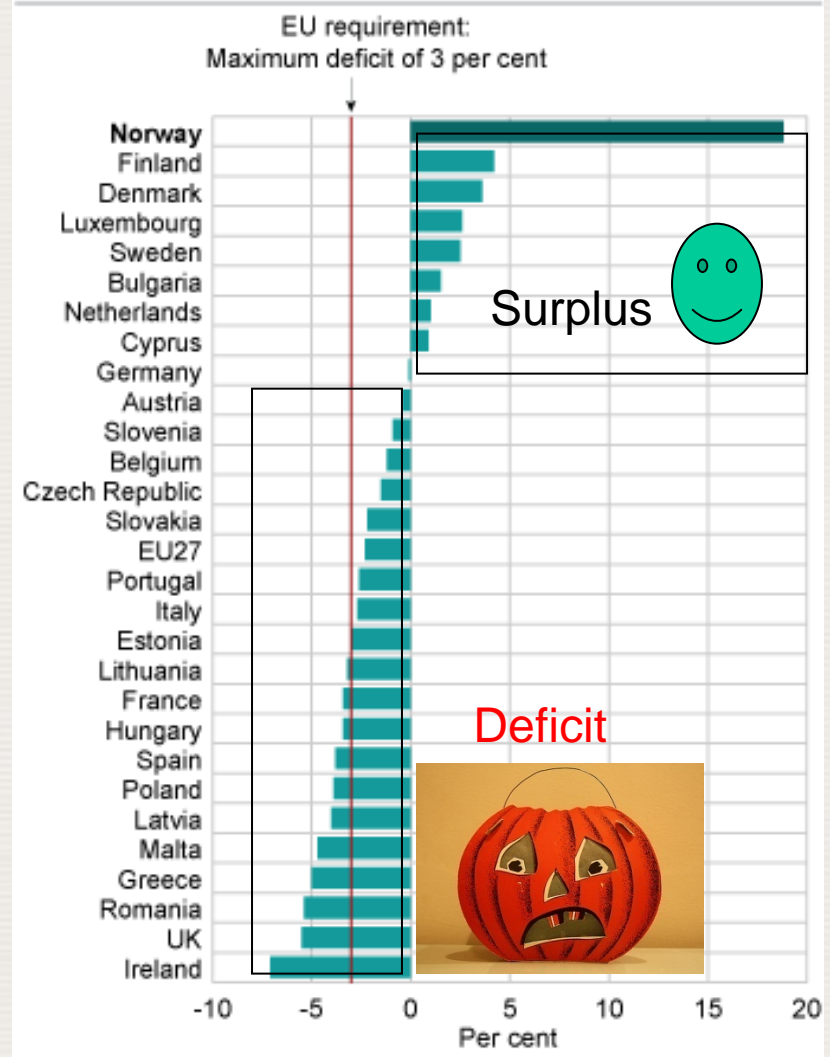
GDP is a measure of economic output



Balance of Payments

- **Balance of payments (BOP):** An accounting record of financial transactions (generally import and export of goods and services) of the country with the rest of the world

General government surplus as a percentage of the GDP. 2008

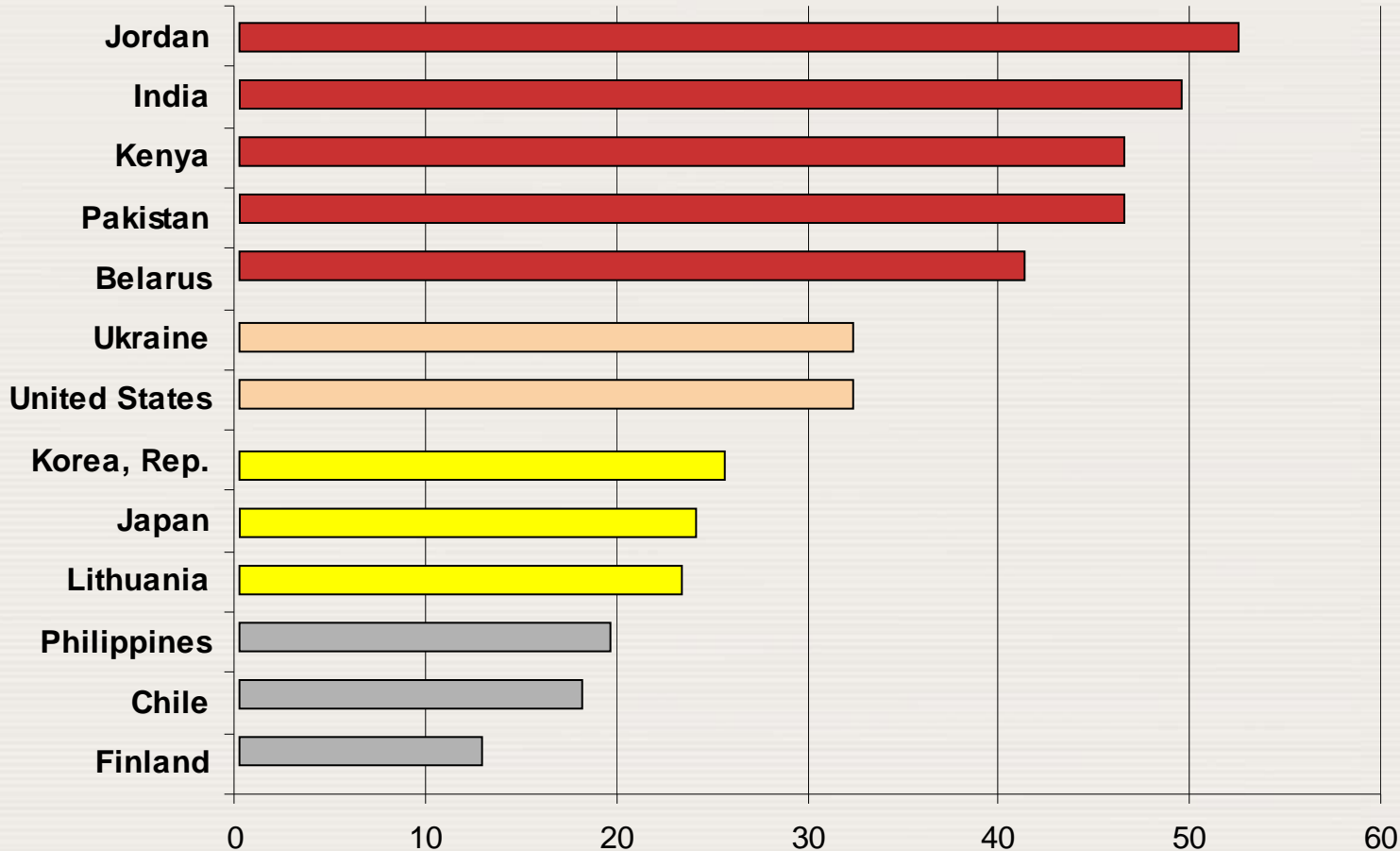


Nuclear investment and BOP

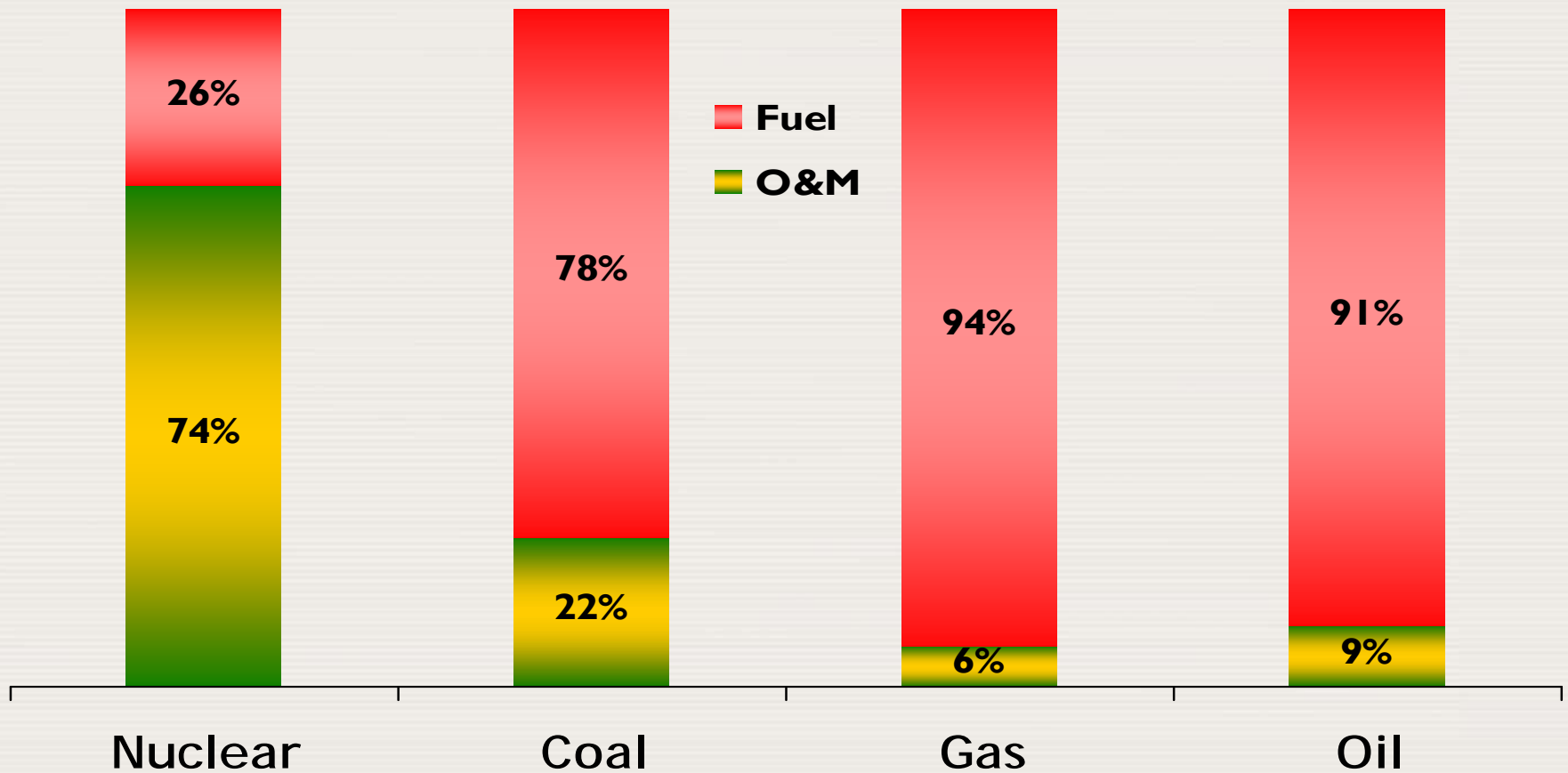
- Nuclear industry can effect BOP in various ways, prominent influencing factor is through the import of fossil fuel, for example:
 - *Higher fossil fuel prices (Jan07-Apr08) strain BOP: Gross impact was more than 2 % of GDP, 37 LIC and 25 middle income countries to have less than adequate reserve (IMF Survey, July 2008)*
 - *Nuclear vs CCGT (1000MW): Gas imports alone would worsen the BOP by 2% (depending on the actual trade balance in future years) over the lifetime of the plant. If future price of imported gas increases or the country currency depreciates, this will further dampen the BOP (IAEA study 2009)*

Note: For several developing countries nuclear technology import will also impact the BOP

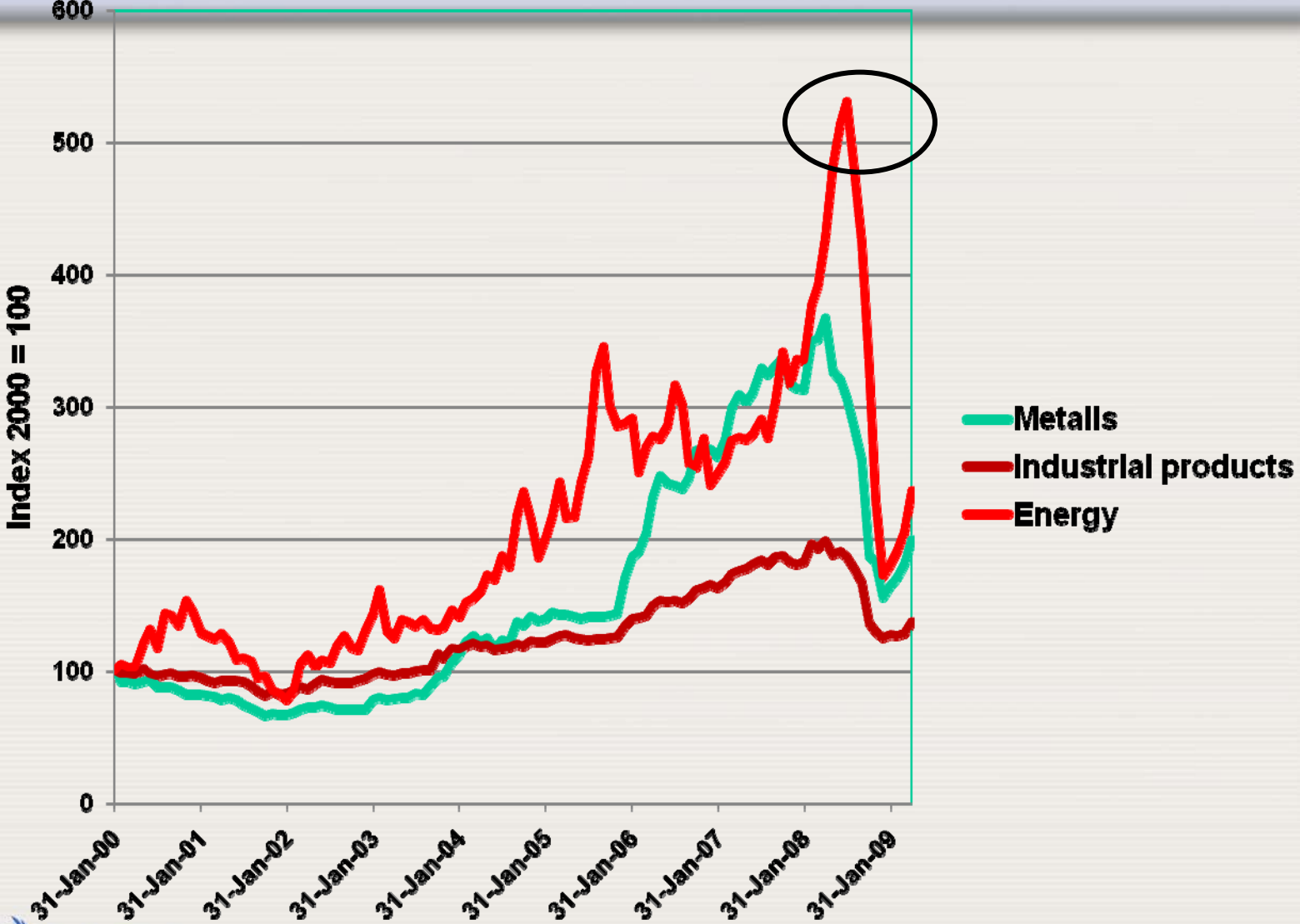
Fuel Imports as percentage of exports (2007)



Fuel as a percentage of marginal generating costs (USA – 2005)



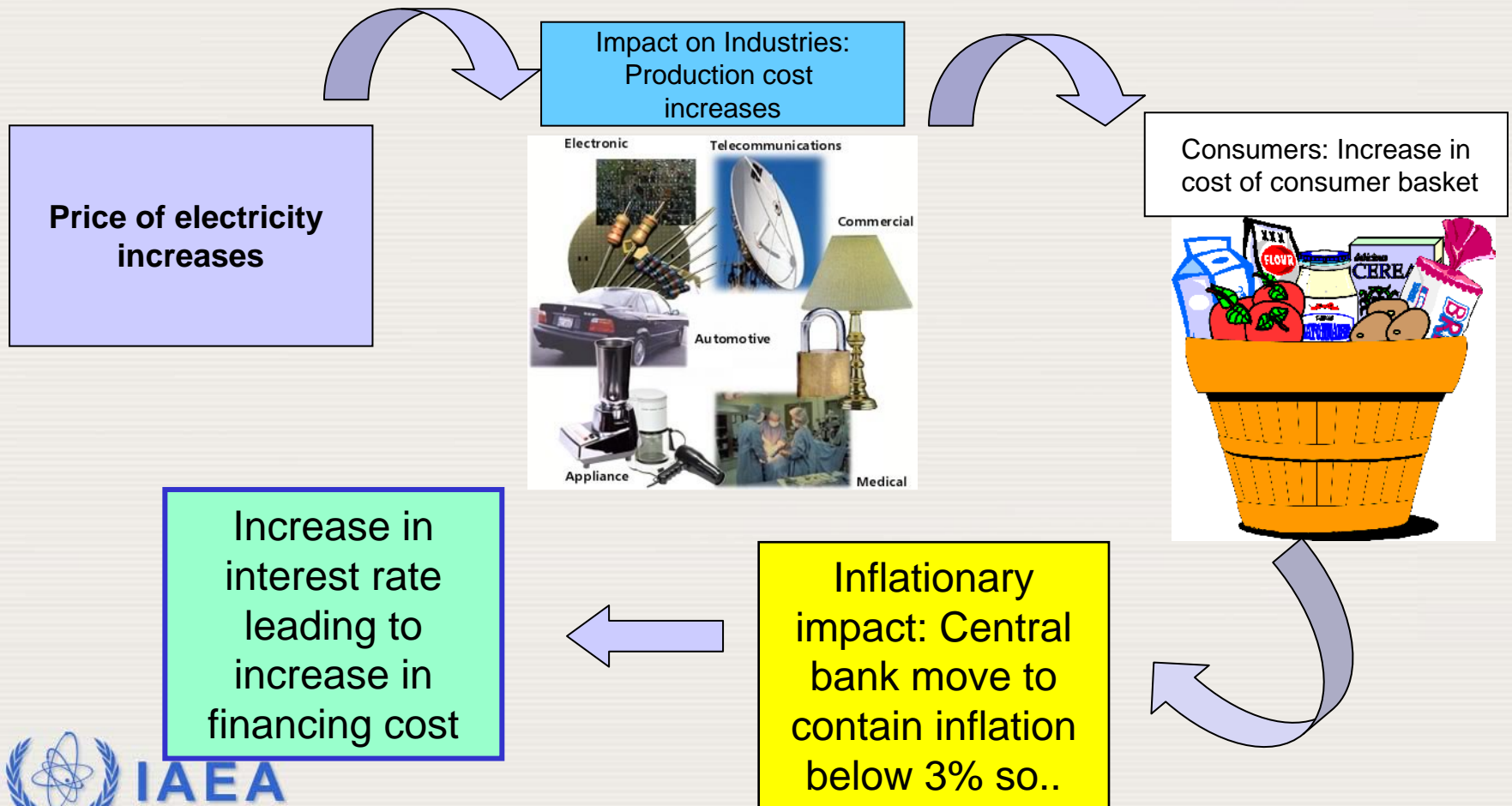
Price dynamics



Price Increase and Inflation

High fuel dependency leads to price instability

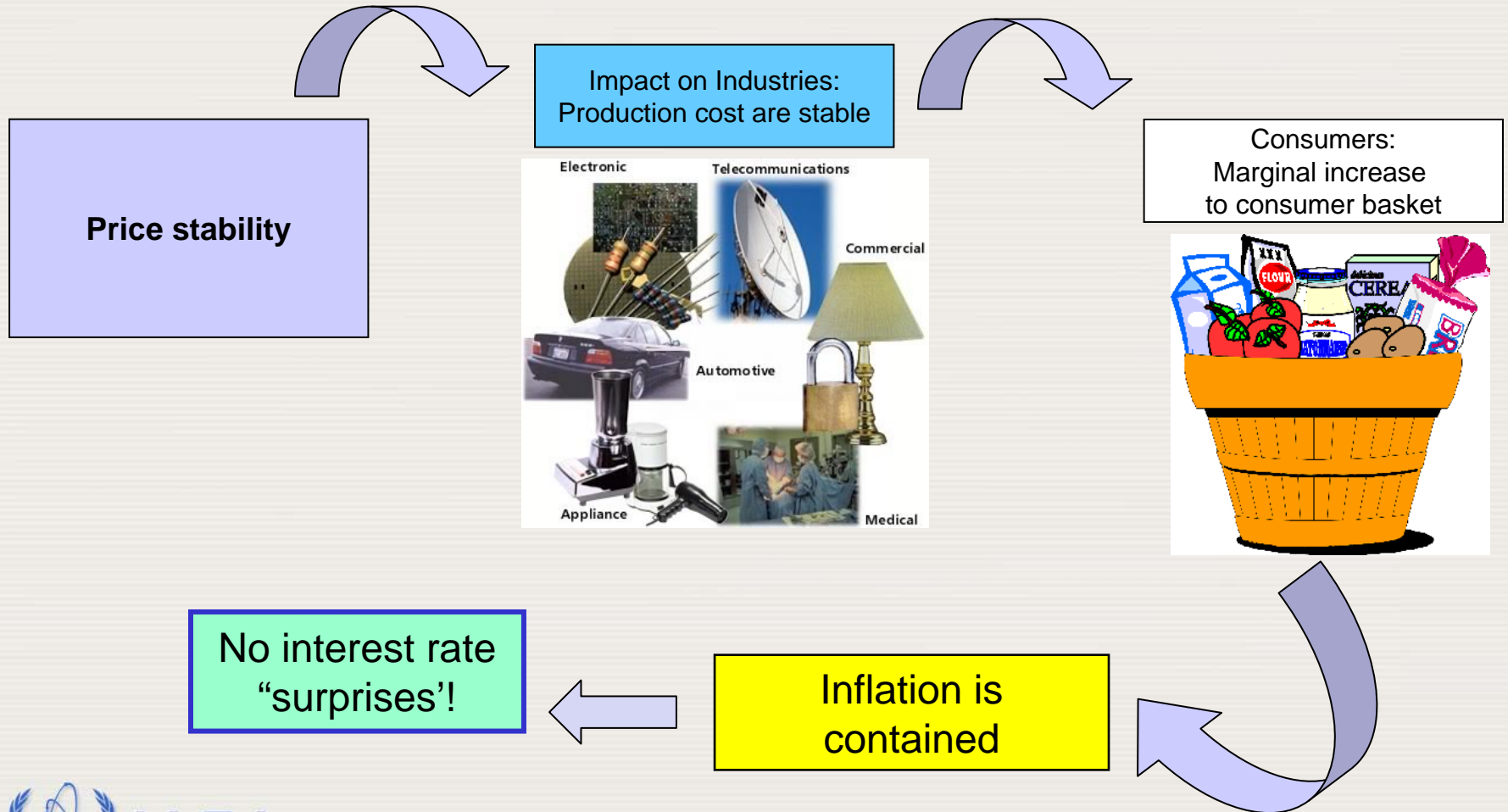
Scenario A: A country is highly dependent on Oil and Gas imports and the prices of both fuel increases (keeping exchange rate constant) – The Spiral Effect:



Price Stability and Inflation

Nuclear low fuel dependency leads to price stability

Scenario B: Nuclear investment decision and stable electricity prices



Higher Fuel Price

Adverse macroeconomic effects:

- Adverse impact on BOP
- Increase in inflation
- Increase in interest rate
- Adverse Social effects on Low income families



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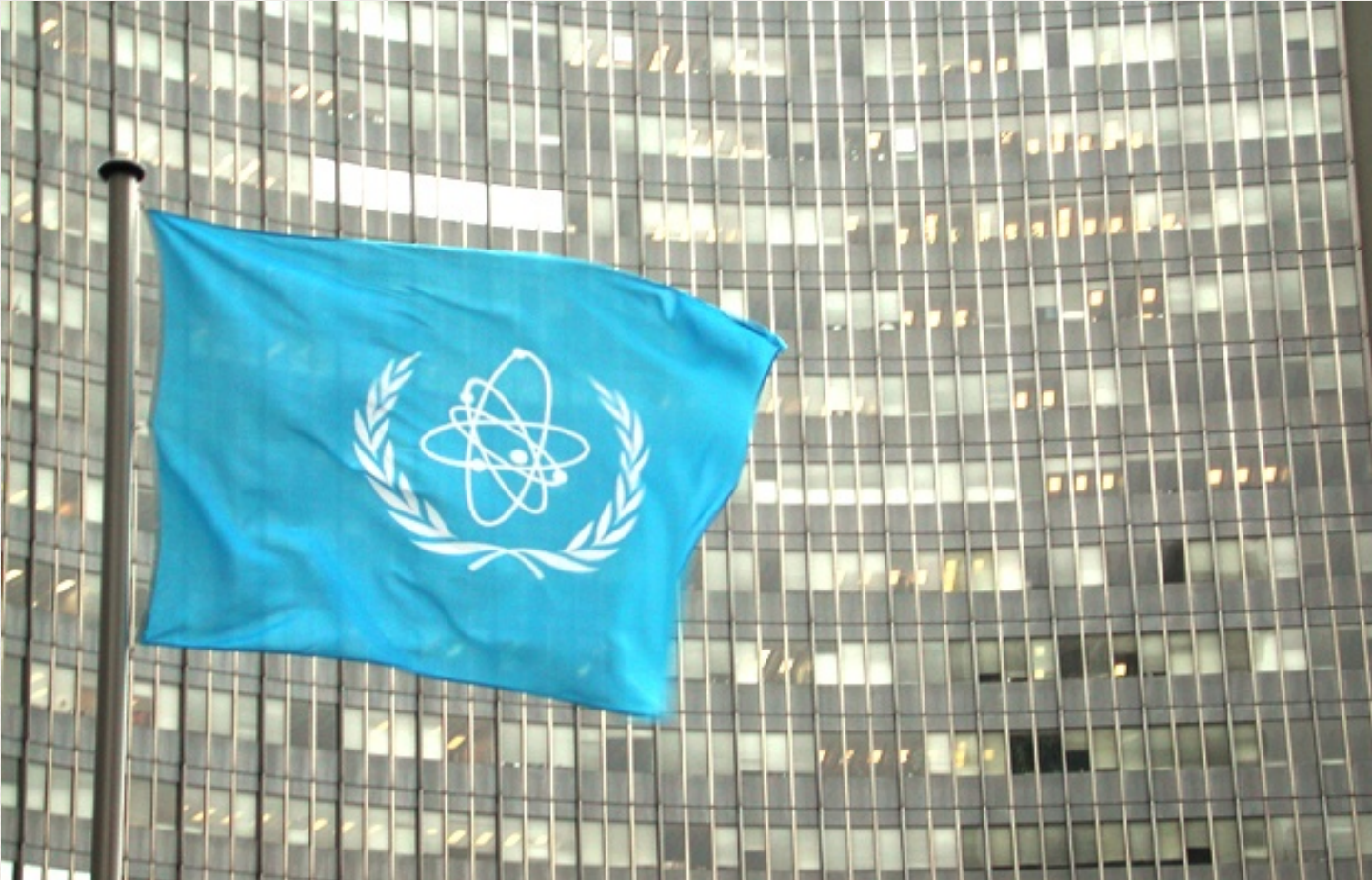
Other important considerations

- **Security of energy supply**
- **Security of electricity supply**
- **Spin-off to other sectors**
- **Socio-cultural effects**
- **Environmental and health benefits**

Concluding comments

- Nuclear investment is a long term decision with significant macroeconomic benefits
- The macroeconomic impact varies across the countries
- Nuclear investment macroeconomic impact depends on the type of nuclear program (like, single unit or a series)
- Low fuel cost and price stability is major influencing factors to nuclear investment decision
- Nuclear industry needs a few 'within budget and on schedule' projects to give the industry a boost

Thank you for your attention!



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