

Nuclear Wind Biofuels Geothermal Nuclear  
Geothermal Wind Solar  
Marine Marine  
Biofuels  
**Solar**

Utilities Sector

## Pre-conditions for Financing Nuclear power

‘Randvoorwaarden’ voor Financiering van Kerncentrales

Alexander Alting von Geusau

November 2006

ING 

WHOLESALE BANKING

# Contents

1. Introduction & benefits of Nuclear
2. Dynamics of financing
3. Key Risks
4. Case study: Olkiluoto 3
5. Government measures
6. Conclusion

# Introduction & benefits of nuclear

# Introduction

## Why Nuclear?

- Security of supply – reliance on politically unstable regions
- Environment
- Economically affordable

## Changing Dynamics

Dynamics of Nuclear Power plants is changing from Government to mostly Private sector. What are possibilities for private funding?

## Conditions for funding

- To access private sector funding requirements we need to look at
  - what are the key risks to lenders & how can we mitigate risks
  - what has been done, what can we learn and how did it work
  - impact of 'Notitie van Geel' (Randvoorwaarden voor nieuwe Kerncentrales)

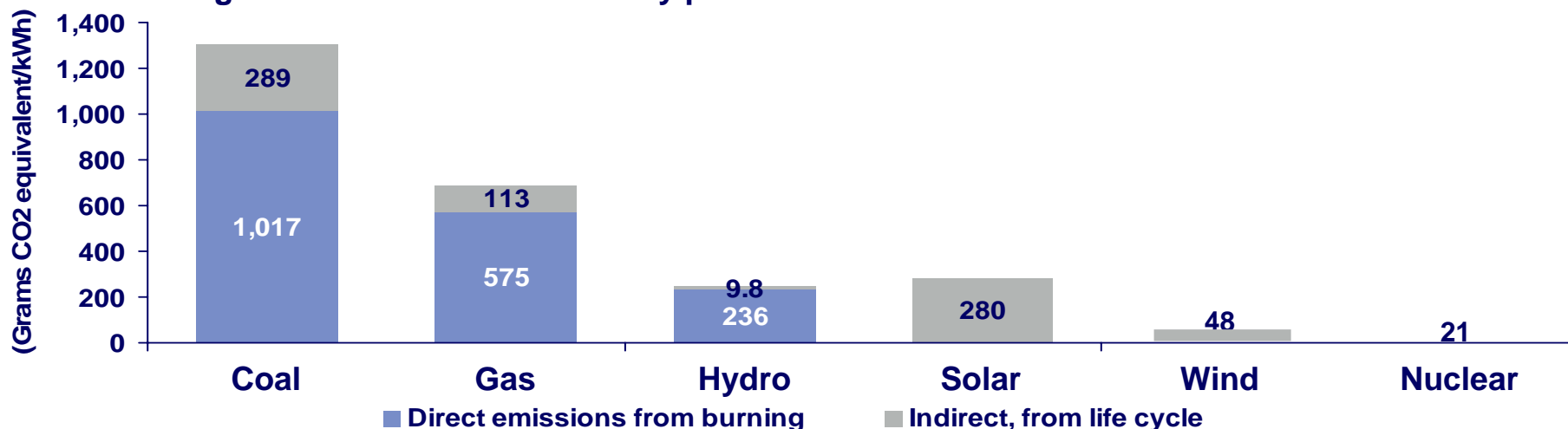
## Government Support

For Nuclear to be a viable option what support is needed from the Government?

# Benefits of nuclear

## Environment

### Greenhouse gas emissions from electricity production



Source: IEA, 2002 is latest available data

### CCGT equivalent CO<sup>2</sup> emissions

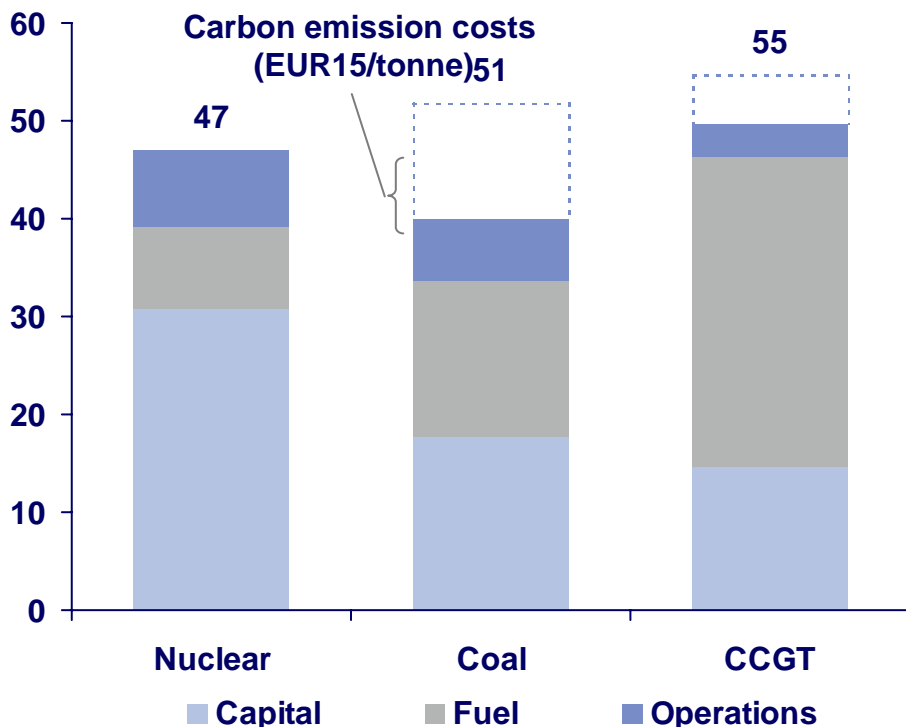
	Nuclear Prod (TWh)	CCGT Equivalent CO <sup>2</sup> (t mn)	Kyoto 2012 Targets (t mn)	2002 CO <sup>2</sup> Emissions (t mn) <sup>(2)</sup>
France	427	154	565	567
Belgium	45	16	136	146.9
Finland	22	8	77	71.1
Czech Republic	25	9	177	196.3
Germany	158	57	990	1,230
Spain	61	22	330	289.4
UK	74	27	653	768
Netherlands	3	1.3	201	214

Note: (1) Based on a carbon intensity of 0.36 tonnes/MWh; Source: European Environment Agency, Morgan Stanley Research; (2) Latest figures provided to IEA, base year may vary

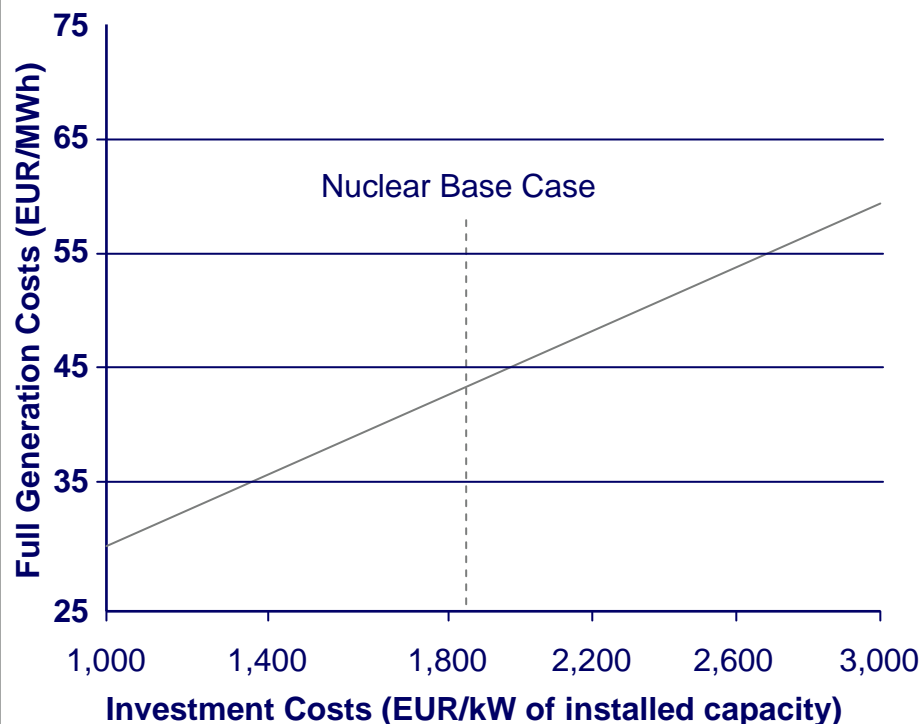
# Benefits of nuclear

## Economic viability

Base case: full generation costs (EUR/MWh)



Sensitivity of full generation costs to investment costs



***Surging commodity prices and impact of CO<sup>2</sup> cost improve economic viability of Nuclear, although fuel prices are volatile and have impact on nuclear without off-take contract***

Source: ING Research estimates

# Dynamics of financing

# Dynamics of financing

## Changing dynamics – Government to private sector

### Ownership evolution

#### Government & State owned companies

France (EDF)  
Sweden (Vattenfall)  
UK (BE)  
Russia  
China  
India

#### Large utilities privatised

Often as a consequence of privatisation

Belgium (Electrabel)  
Germany (E.ON, RWE)  
Japan (Tepco, Kansai Electric, Kyushu...)  
Spain (Endesa, Iberdrola, UF)  
US (Entergy, Exelon, FPL)

#### Independent developers

Finland (TVO)  
US (NuStart, Unistar Nuclear)

### Debt evolution:

Government debt

Equity & Corporate debt

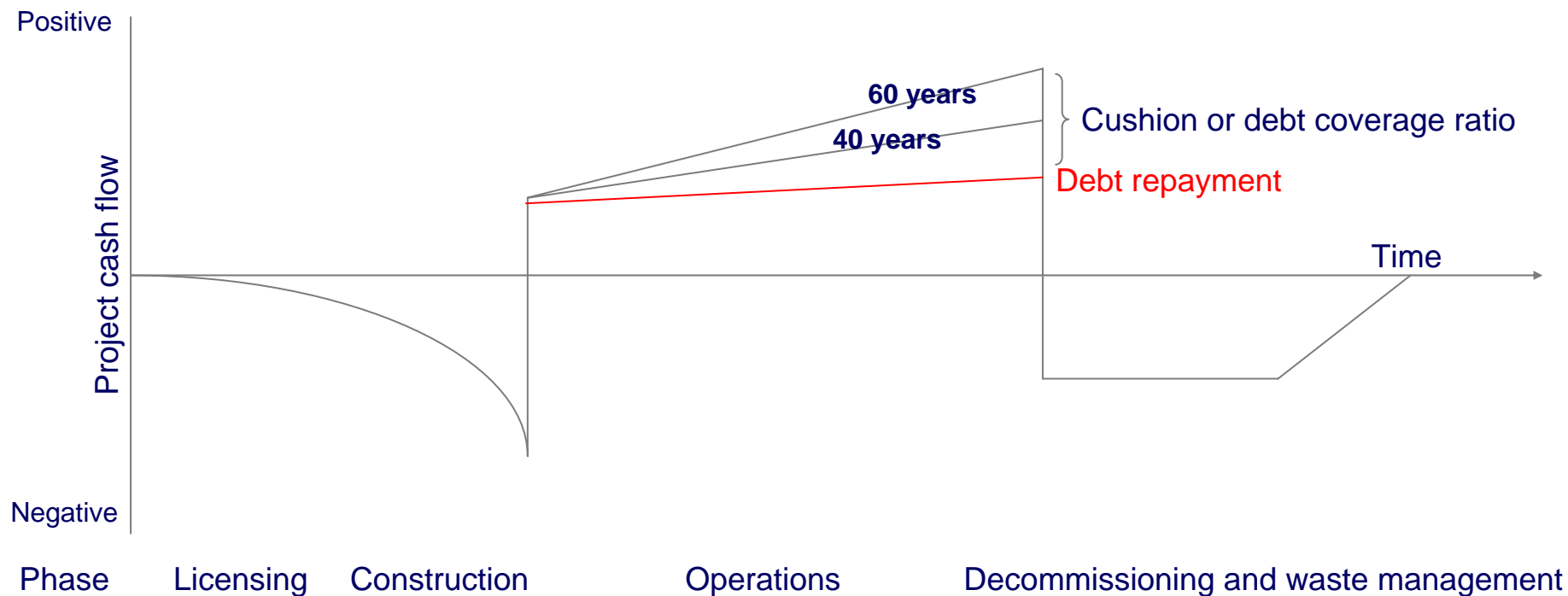
Hybrid debt

➔ *Will true project finance be possible? Level of Government involvement?*



# Dynamics of financing

## Cash flow cycle



**➔ Financing structure impacted by risks and mitigants to cash flow during cycle**

Note: Not to scale

# Dynamics of financing

## Key risks associated with nuclear

### Planning/ development/ construction

- Pre planning process – public opinion and Government support
- Licensing – timing of process and risk of not obtaining a License
- Construction – delay and cost overrun

### Market risk

- Uncertainty environmental policy (CO<sup>2</sup> prices)
- Ability to compete with other fuels
- Price risk influenced by high Capex and long lead time

### Liability & safety

- Accidents on site and/or during transportation of waste
- Environmental accidents
- Depth insurance market

### Waste storage and disposal costs

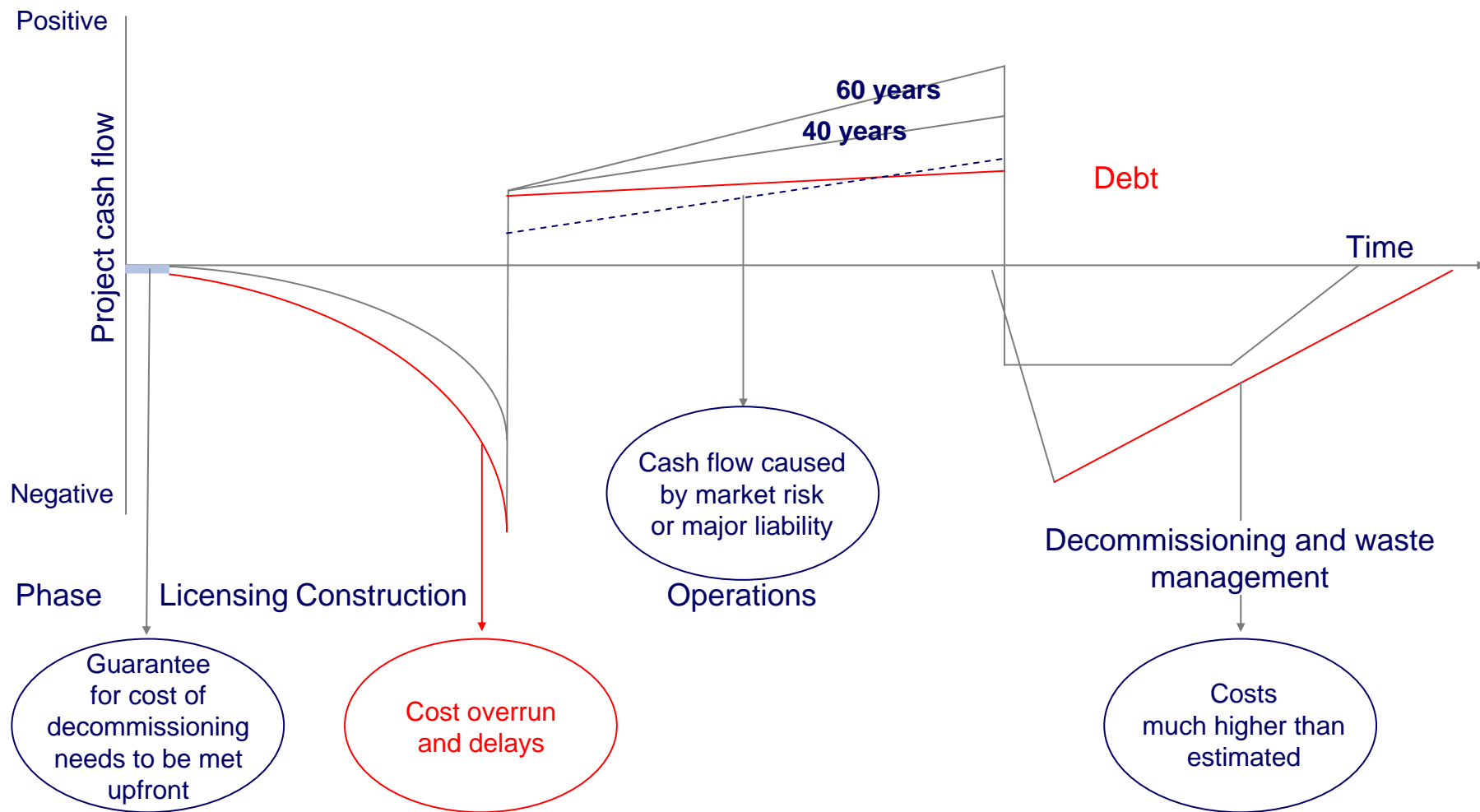
- Government commitment to solution – no solution in most countries
- Public support
- Financial support

### Decommissioning

- Limited experience and widely different cost estimates (EUR200m-2bn/1000MW)
- Dependent on technology and standardisation levels

# Dynamics of financing

## Impact of key risk on cash flow cycle



Note: Not to scale

# Key Nuclear risks

# Key Nuclear risks

## Market risk

- Government can mitigate market risk by:
  - some sort of **subsidised mechanism** to assist with the increased capital costs of new generation nuclear units:  
e.g.: **Federal Guarantee 2005 US Energy Policy Act for up to 80% of project cost**
  - Also, Clear environmental policy  
e.g.: Kyoto,  
CO<sup>2</sup> allocation
- Developers can mitigate market risk through
  - Long term off-take contracts

 ***Lenders may take limited amount of price risk if coverage ratios are robust***

# Key Nuclear risks

## Planning/licensing/construction

- Governments/regulatory bodies need to set adequate legal framework
  - Addressed by 'Notitie van Geel'
  - e.g. the new Combined Construction and Operating License introduced in the US
  - the standby support coverage proposed by the **2005 US Energy Policy Act** provides financial cover for delays beyond the industry's control
- Contractors & developers: expected to assume the bulk of these risks once the **regulatory bodies** have **set the adequate framework**

 ***Lenders unlikely assume development & construction risk due to long lead times***

# Key Nuclear risks

## Waste storage, disposal costs & decommissioning

- **Government needs to be commitment to solution for waste disposal**
  - Addressed by 'Notitie van Geel'
  - Provide stable **regulatory framework**
  - Adequate research, know how support & coordination with other countries
- **Sharing of risk by industry players and/or the Government**
  - **dedicated provisioning** of internal or external funds financed by operators
  - **State responsibility** such as in the UK (National Decommissioning Authority and the Nuclear Liabilities Fund) and Spain (Enresa)

 ***Lenders unlikely to assume waste & decommissioning risk***

# Key Nuclear risks

## Safety and liability

- **Government support in setting National energy policies**
  - need to close oldest plants
  - ensure new plants meet best standards & operated by highly experienced nuclear operators
  - high level of industry discipline is maintained
- **Need to raise the depth of the Insurance market for liabilities**
  - ability to provide financial security to meet increased liability amount
  - currently inability to provide cover for the full re-instatement value?
- **International Conventions & certain National acts and laws address limitation of liability**
  - Paris and Vienna Conventions, subsequent Brussels convention, national nuclear legislation
  - Price-Anderson Act and EPACT 2005
    - › first US\$300m liability to be insured by each reactor
    - › above and up to US\$96m per reactor, mutualisation of the risk among all US nuclear operations

 ***Lenders will require significant insurance before considering these risks***



# Finland case study – Olkiluoto 3

# Finland case study – Olkiluoto 3

## Project in a nutshell

### Sponsors

- Teollisuuden Voima Oy (TVO) is a privately owned generating company established in 1969
- Main shareholders of TVO are Fortum and PVO, who are active participants and risk sharers

### Existing Nuclear Power Plants

- 2 X 860 MW, BWR, Westinghouse Atom (Olkiluoto 1 and 2)
- Commercial operation in 1979 and 1982
- Modernization and upgrade in 1994...1998 and 2005...2006

### New Nuclear Power Project: Olkiluoto 3

- Planning started in 1997
- Investment decision: December 18, 2003
- Start up: 2010
- Reactor type: EPR (PWR)
- Net Electrical output: 1,630 MW
- Investment cost: EUR3bn

# Finland case study – Olkiluoto 3

## Pre-conditions (Randvoorwaarden) investment considerations

### Public & politics

- Broadly **favourable public opinion**
- Long term **political support** for nuclear
- **Proper political process**
- Some **recognition for carbon-free generation** with long term certainty

### Legal & financing

- **Transparent legal framework** for licensing & planning

### Waste

- **Waste management solution** agreed, implemented and funded

### Strong project parties

- **Stable and committed organisation** and management
- **Reliable and creditworthy shareholders**, and favourable rating treatment
- **Committed project counterparties**

 ***Need to create similar favourable environment***

Source: Case Study: Financing the Olkiluoto 3 project, Lauri Piekkari, TVO, Euromoney Conference

# Finland case study – Olkiluoto 3

## Key commercial factors contributing to the success of nuclear build

### Construction

- The construction of the plant is under **turnkey contract** ('fixed price') arrangements

### Proven technology

- Deployment of a **proven technology** (EPR), with a 40 year economic lifetime

### Operation

- TVO are recognised as highly successful and **reputable nuclear operator**, with high performing plant

### Off take

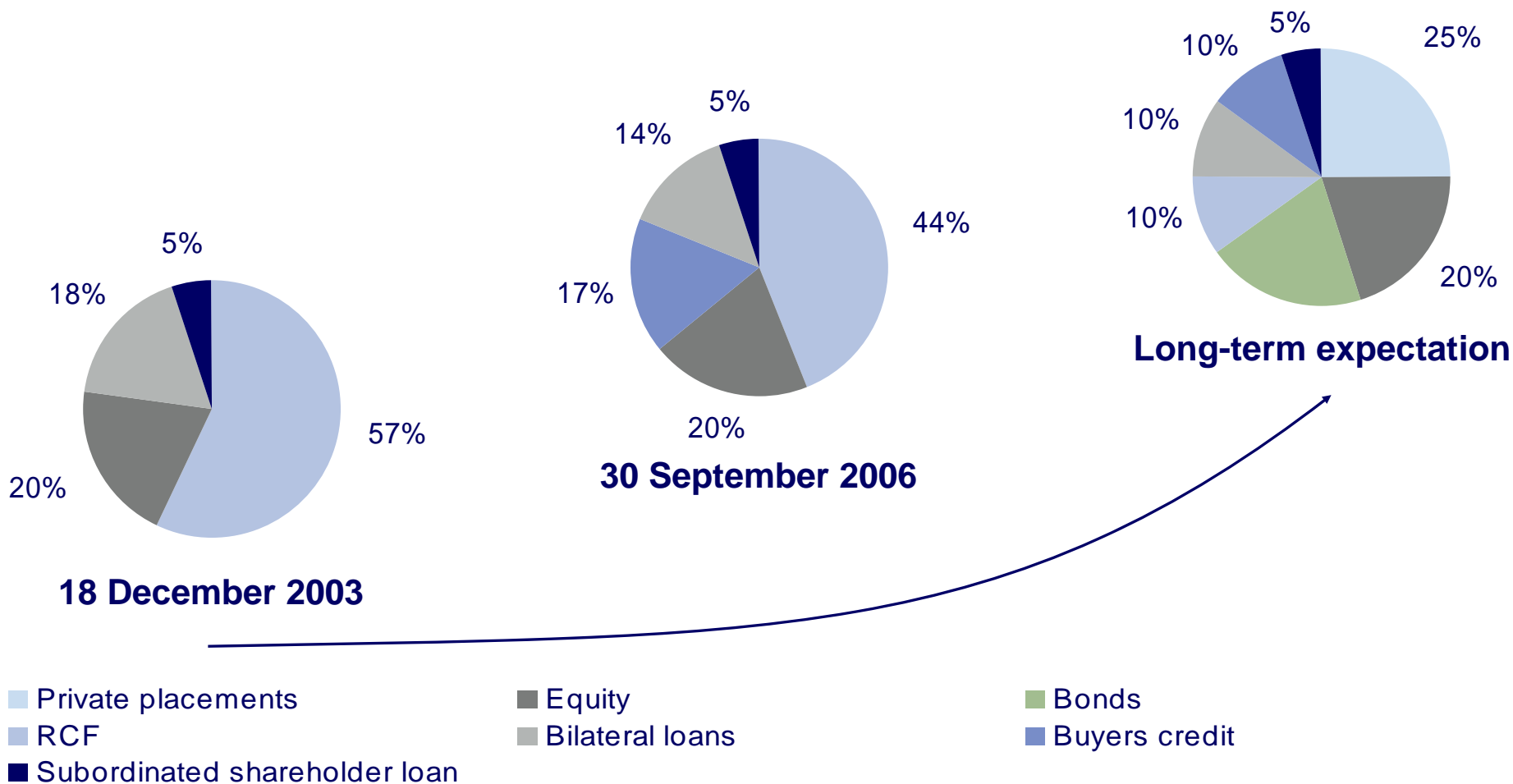
- There are **long term off take contracts** in place (~15years) from a wide group of high/intensive energy users

### Financing

- Construction and operation is being **financed by 20% equity and 80% debt** (5% shareholders of TVO and 75% from banks)

# Finland case study – Olkiluoto 3

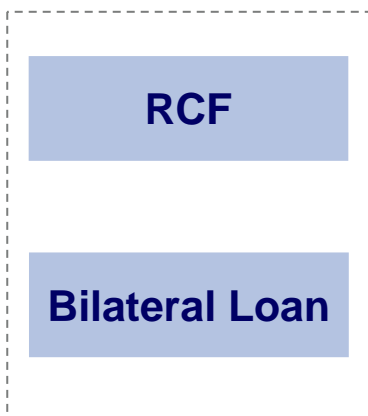
## Financing structure development



Source: Case Study: Financing the Olkiluoto 3 project, Lauri Piekkari, TVO, Euromoney Conference

# Finland case study – Olkiluoto 3

## Solutions of the current structure, and future aspirations...



- Medium term facility, 5 & 7 year loan tranches
- Flexibility during construction, to cover construction costs
- No publicity
- Assume same terms RCF

- **Buyers credit**
- **Private placements:** long term asset, matching long-term pension liabilities (Canada)
- **Bonds:** Provides investors with alternative energy asset (Current rating A- by Fitch)
- Non or Limited Recourse **Project Finance?**

Source: Case Study: Financing the Olkiluoto 3 project, Lauri Piekkari, TVO, Euromoney Conference

# Finland case study – Olkiluoto 3

## Lessons learned

### Financing structure

- Not Project Finance, but on balance sheet structured lending
- Structure is set to allow for financial flexibility & refinancing
- Long term and more efficient financing after completion
- Refinancing risk taken by shareholders

### Key Risk

- Planning and licensing – sponsors and Government
- Construction risk allocated to contractors and sponsors
- Market risk taken by offtakers and sponsors
- Operational risk are taken by sponsors
- Waste solution and decommissioning – sponsors and Government

 ***Lenders not yet comfortable to take key nuclear risk and as such provide Long Term Project Finance***

# Government measures



# Government measures

## Public opinion

- Need clear Government support for new nuclear as part of the future energy mix

## High costs & liabilities

- Because of the high upfront costs and the additional back-end nuclear liabilities, some kind of government backing is usually required to encourage investment – US EPACT 2005

## Regulatory requirements

- Regulation/nuclear industry/government need to develop planning and approval processes so as to minimise delay and uncertainty (Including setting down clear practical public consultation processes) – US EPACT 2005

## Waste & decommissioning

- Government setting and progressing implementation of policy on the management of radioactive wastes and decommissioning process and costs – **UK & Spain** (Responsibility state) **Nordic** (Shared but corporate have ultimate responsibility), **‘Notitie van Geel’** (full corporate responsibility)

# Government measures

## Market risk

- Government actions to stimulate investment in new nuclear, addressing both the lack of long term pricing signals in the market and the perception of risk among investment institutions (including arrangements to incentivise investors and vendors to fund the early phases of pre-construction activities) – US EPACT 2005

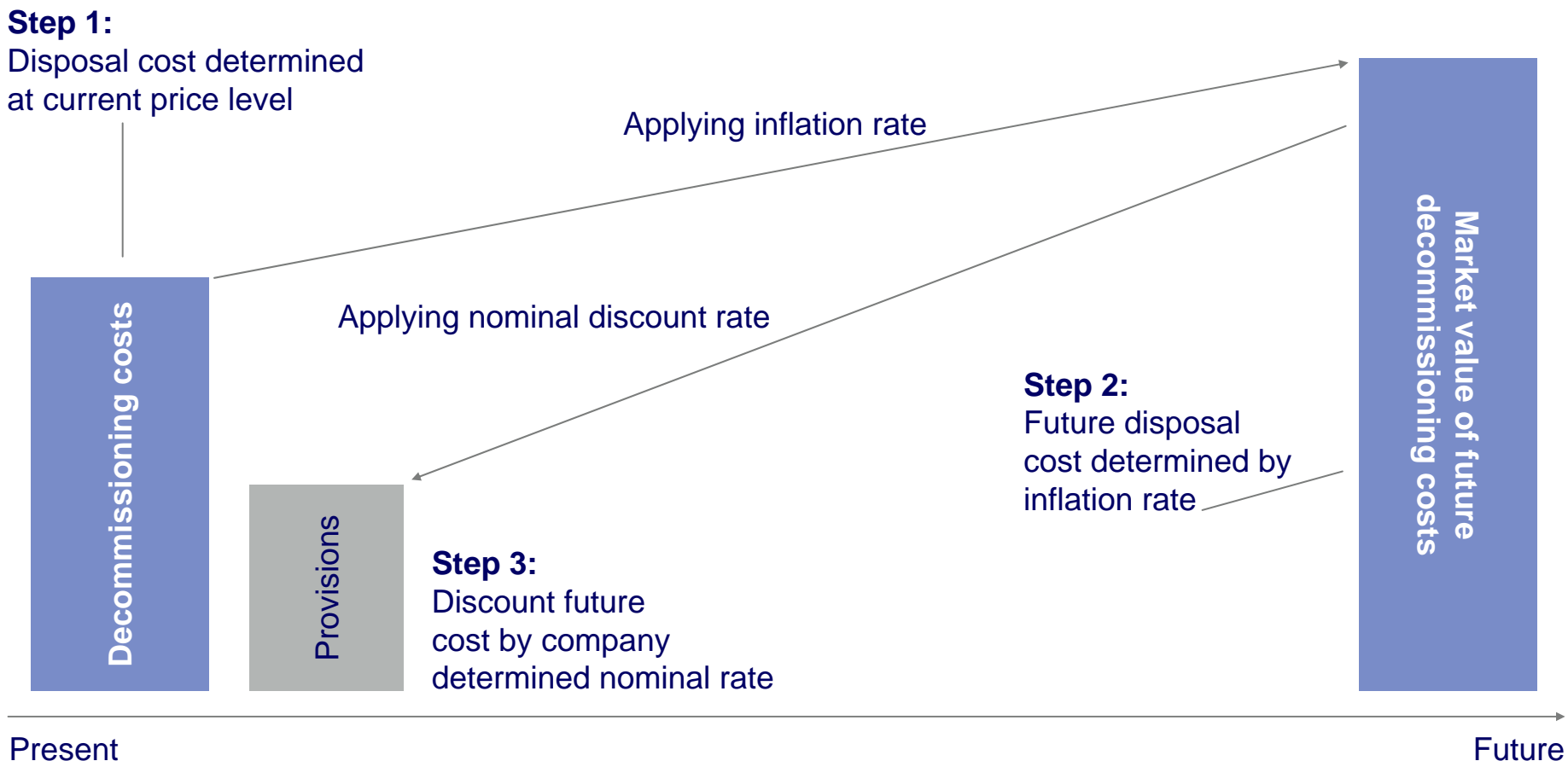
## Research & expertise

- Government needs to ensure that adequate research is undertaken in support of nuclear and that the necessary expertise is available and shared in the market where required

 ***Partly addressed by Randvoorwaarden***

# Government measures

## Determining the nuclear decommissioning costs



➔ **What is the impact of 'Notitie van Geel' with regard to the upfront Guarantee?**

# Public Private Partnership (PPP)

## Possible solutions



➔ ***If Government willing to share key nuclear risks, financing with more limited recourse to the sponsors will be possible***

# Conclusion

# Conclusion

## Government support & regulation

- Government will need to be actively involved in Nuclear process from forming of public opinion to decommissioning
- Due to political aspect of Nuclear, clear and stable regulatory framework is required
- require Government support or insurance for risks beyond industry control or too large



## Developers and contract parties

- Public private partnership a possible solution
- Developers and contract parties will have to take bulk of risk
- Utilities and contract parties likely team up to share risks

## Lenders

- Not yet comfortable with key risks
- Project finance/non recourse difficult in short term
- Corporate & hybrid facilities likely route