

# Judge Business School

## Financing the Nuclear Renaissance

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**CAMBRIDGE**  
Judge Business School

# Summary

1. the traditional (old) way of financing nuclear (on-balance sheet, regulated utilities)
2. infrastructure financing today - project finance
3. difficulty of project financing the first few nukes
4. feasibility of project finance once a credible construction record has been built
5. additional ways of getting finance in and lowering the cost of capital; securitisation, hedge funds and private equity.



# Traditional nuclear financing

Integrated and regulated utility(ies) fund on-balance sheet.

Risks borne by shareholders and captive customers (via regulator)

Cost of capital not made explicit

Cross subsidy from other regulated businesses

No longer works because generation is typically deregulated



# Options for new nuclear finance

1. On balance sheet finance (like the traditional route but without regulatory protection)
2. Project finance (like other large infrastructure)
3. Extensions/innovations

# On-balance sheet

Company uses existing balance sheet, raising new debt and/or equity as needed against whole asset base.

E.g. EDF total book equity €28.8bn; net debt €16.3bn (debt/equity ratio 57%)

Approximate cost of EPR: €3bn

How many could EDF fund without over-stretching balance sheet: 2-3?



# Scale of financing needed

Annual construction: 20 stations at \$5bn each = \$100bn

Average construction period: 5 years

Annual flow of financing: \$20bn

Most of this needs to be equity at the construction phase

Compare:

Cost of infrastructure spending in the US over next five year \$1,600bn <sup>(1)</sup>

Infrastructure funds currently raising c\$100bn (Goldman Sachs, Macquarie, CVC etc) <sup>(2)</sup>

**So: nuclear is not that big, but faces a lot of competition**

(1) Estimate by American Society of Civil Engineers New York Times 27 August 2008

<http://dealbook.blogs.nytimes.com/2008/08/27/money-squeeze-prompts-new-debate-on-infrastructure-privatization/>

(2) Watson Wyatt 29/09/2008

<http://www.efinancialnews.com/usedition/index/content/2451982829/>



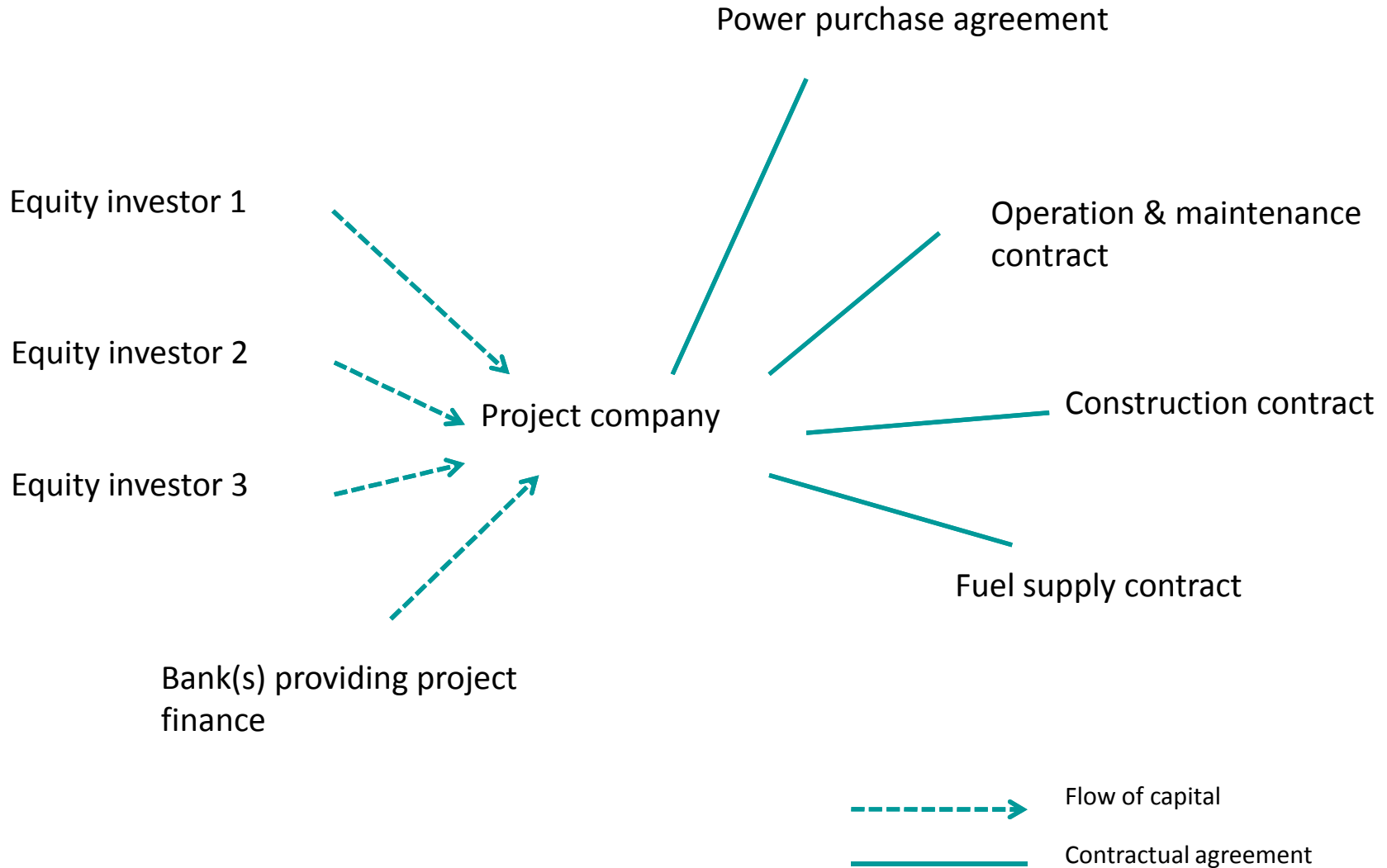
# Modern infrastructure finance: project finance

Project finance: use of non-recourse debt secured on the project investment, not the corporate sponsor.

Allows:

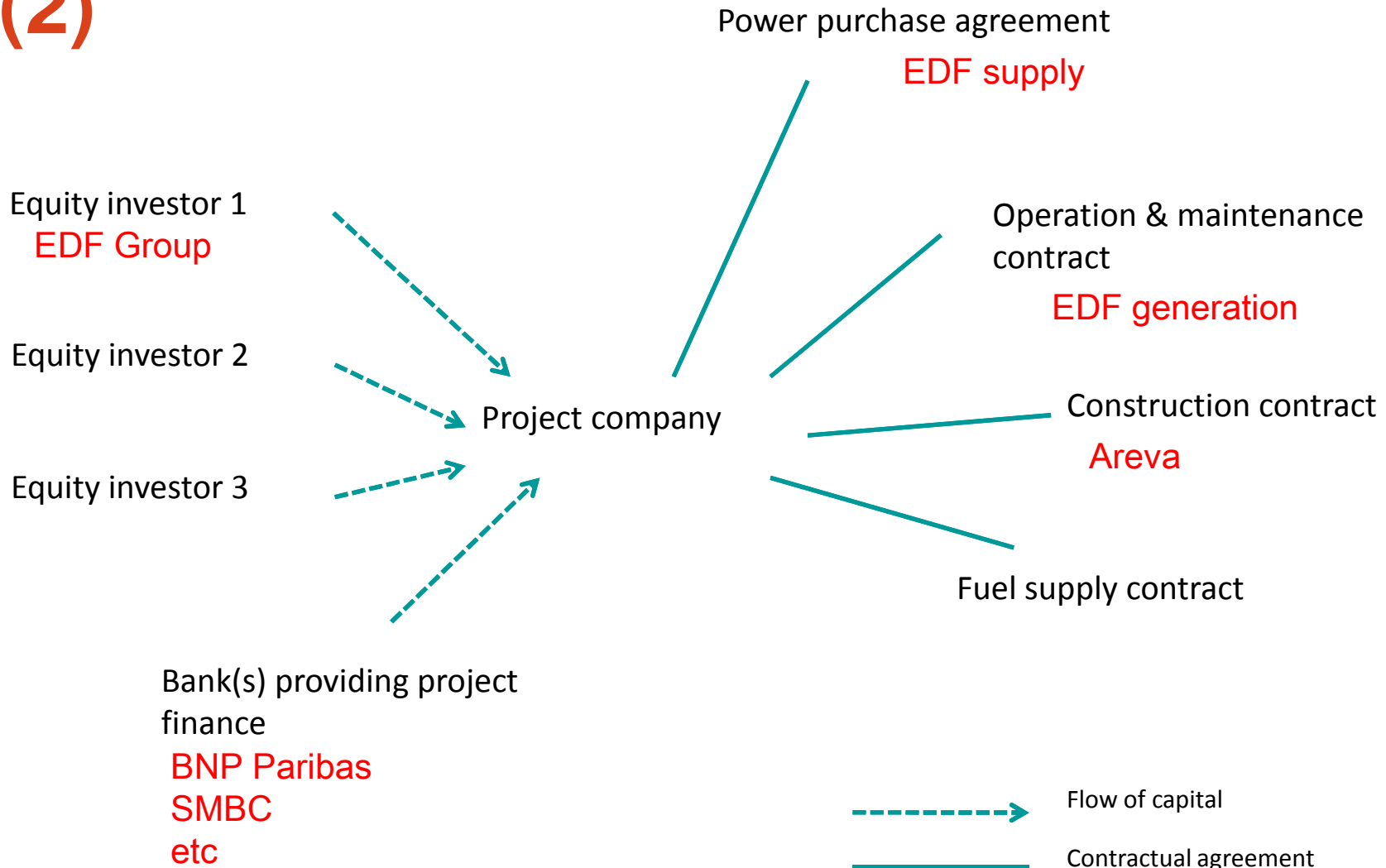
- i) Much higher gearing/leverage
- ii) Better risk allocation
- iii) Easier access of third party investors

# Schematic project finance structure

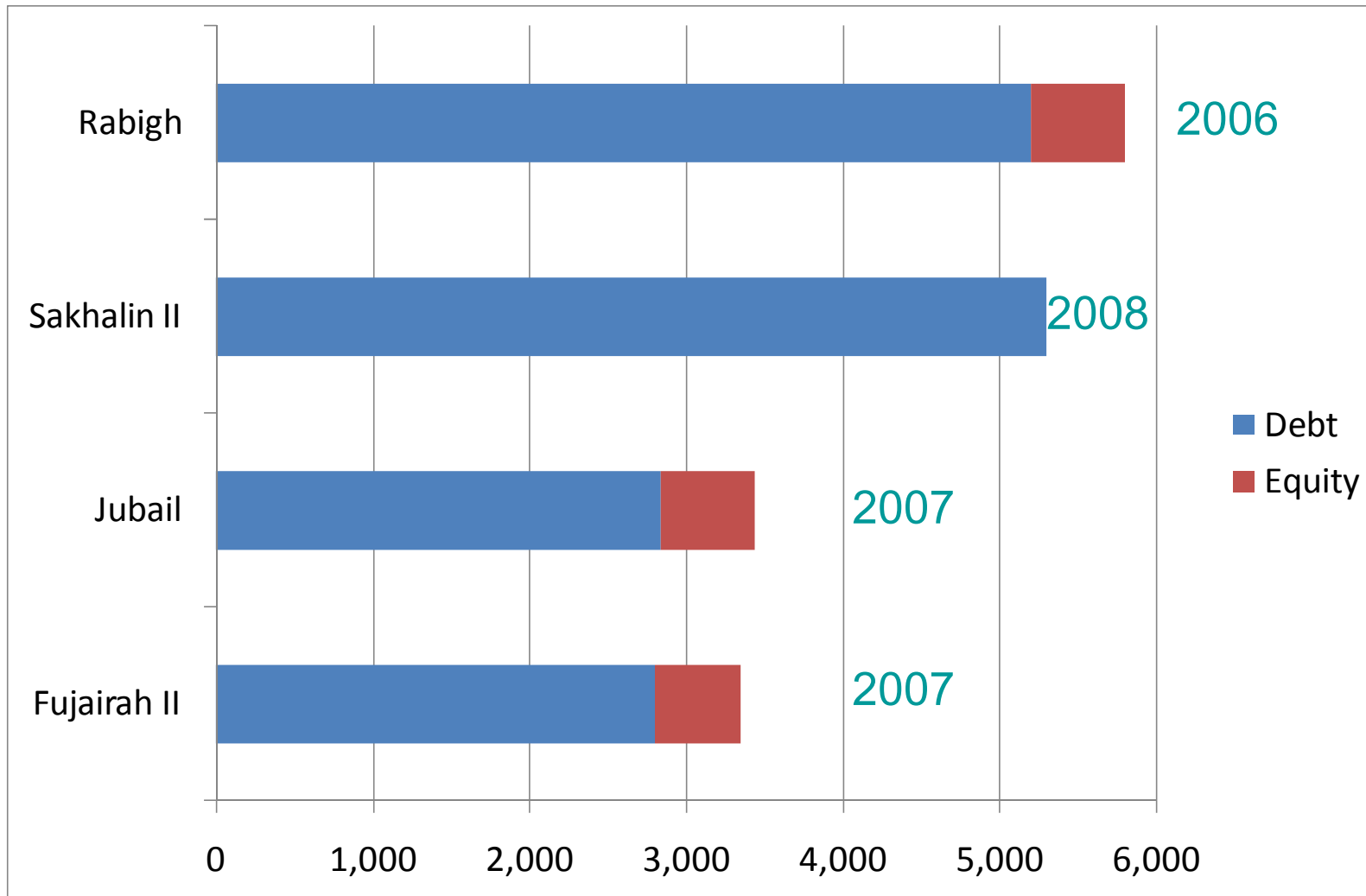




# Schematic project finance structure (2)



# Some recent large projects (\$bn)



# Examples of project financing

Location	Project	Year	Debt	Equity	Lenders	Sponsor(s)
Rabigh, Saudi Arabia	Oil refinery & petrochemicals complex	2006	5,200	600	Japan Bank for International Cooperation Overseas; Public Investment Fund of Saudi Arabia; commercial banks	Saudi Aramco, Sumitomo Chemicals
Sakhalin II, Russia	Integrated gas & oil development	2008	5,300		Japan Bank for International Cooperation + commercial banks	Gazprom, Royal Dutch Shell, Mitsui, Mitsubishi
Fujairah F2 , Abu Dhabi	Power plant & desalination plant	2007	2,800	550 (*)	Calyon, Citigroup, SMBC	Abu Dhabi Water & Electricity Authority, International Power, Marubeni
Jubail, Saudi Arabia	Power plant & desalination plant	2007	2,843	600(*)	BNP Paribas and 28 others	Suez Energy, Gulf Investment Corporation, Saudi investors

(\*)Islamic financing

Total global project finance Q1 2008 \$58bn

90% bank loans, 10% bonds

91% of total was energy & infrastructure



# Risks of nuclear vs CCGTs

	CCGT	Nuclear	Comment
Approximate scale of capital investment (\$m)	150-750	2,000-3,000	CCGTs can be small, and are of low capital intensity
Construction risk	Well defined	Not well defined	Makes project finance impossible for early stations
Technology risk	Low for proven turbines; significant for newer designs	Substantial for new designs until operating record built up	Decays as operating hours rise; type specific
Supply contract	Very important; terms available	Less economically important but also a less liquid market	Likely to be bundled with operations agreement
Sales contract	Very important	Very important; scale makes multiple buyers likely	Requires substantial retail supplier with strong balance sheet
Operating and maintenance (O&M) contract	Plenty of potential operators	Very few potential operators; likely to be project sponsors	
Political risk	Low	Significant; high in some countries	
Regulatory risk	Low	Significant; high in some countries	



# So: why not project finance nuclear?

Construction risk!

Nuclear investment has two phases:

Construction	Operation
Very high risk	Much lower risk
Low debt/equity ratio	High debt/equity ratio

4-5 years

Terrible track record

40-60 years

Very good (recent) track record



# Project finance is feasible IF several stations are built on time/budget

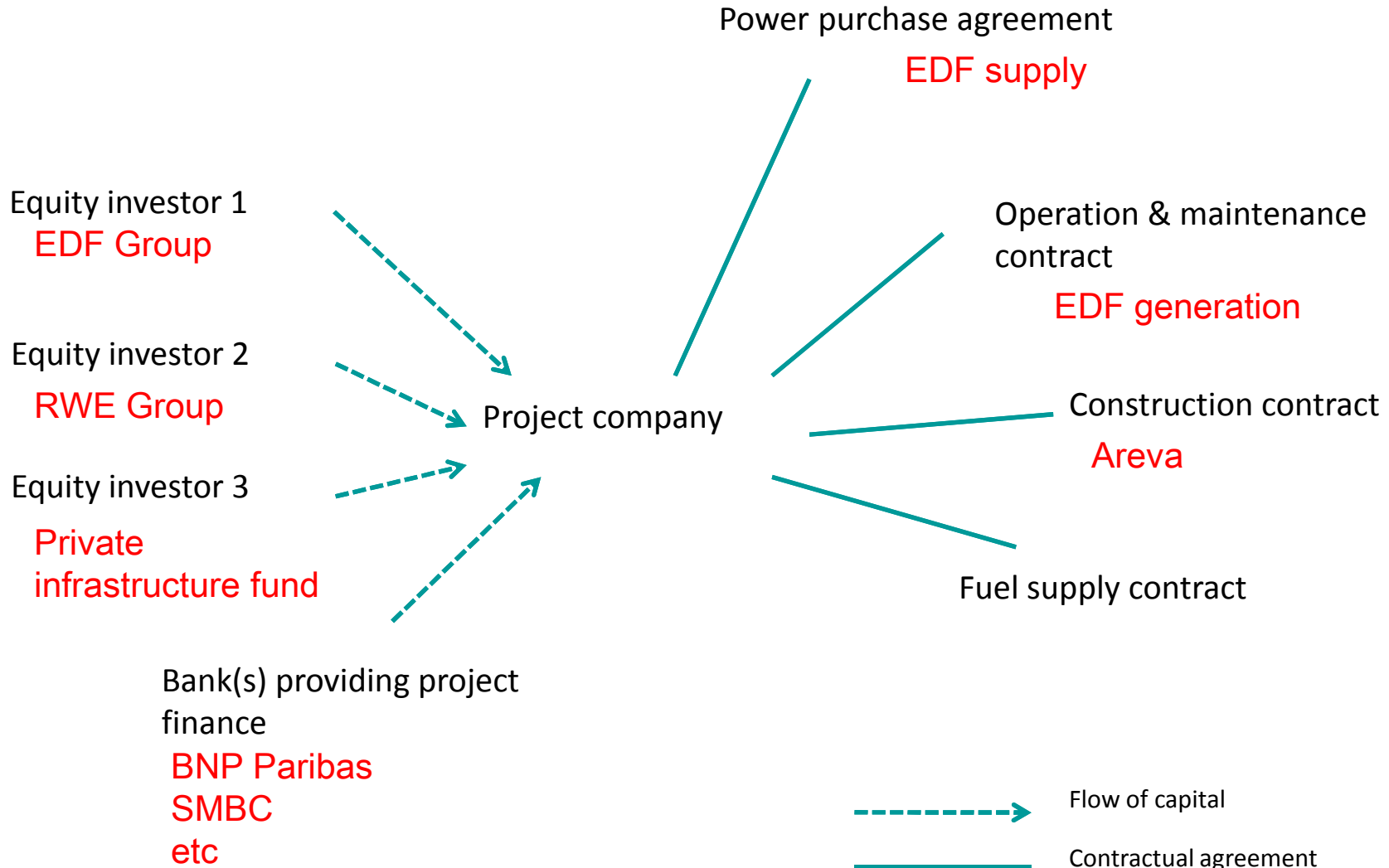
How many?

Recent record:

Olkiluoto – €1bn over budget, 2-3 years late

Flamanville - ?

# Advantages of project financing



# Infrastructure funds

Popular in 2006-2008 because:

tangible assets

strong underlying demand for capital

long lived assets

(in some cases) element of monopoly power

Estimate of total funds raised in last three years: \$250-350bn





# New pools of finance

Hedge funds: specialist nuclear investors

Private equity: ditto

Sovereign wealth funds: hydrocarbon hedge

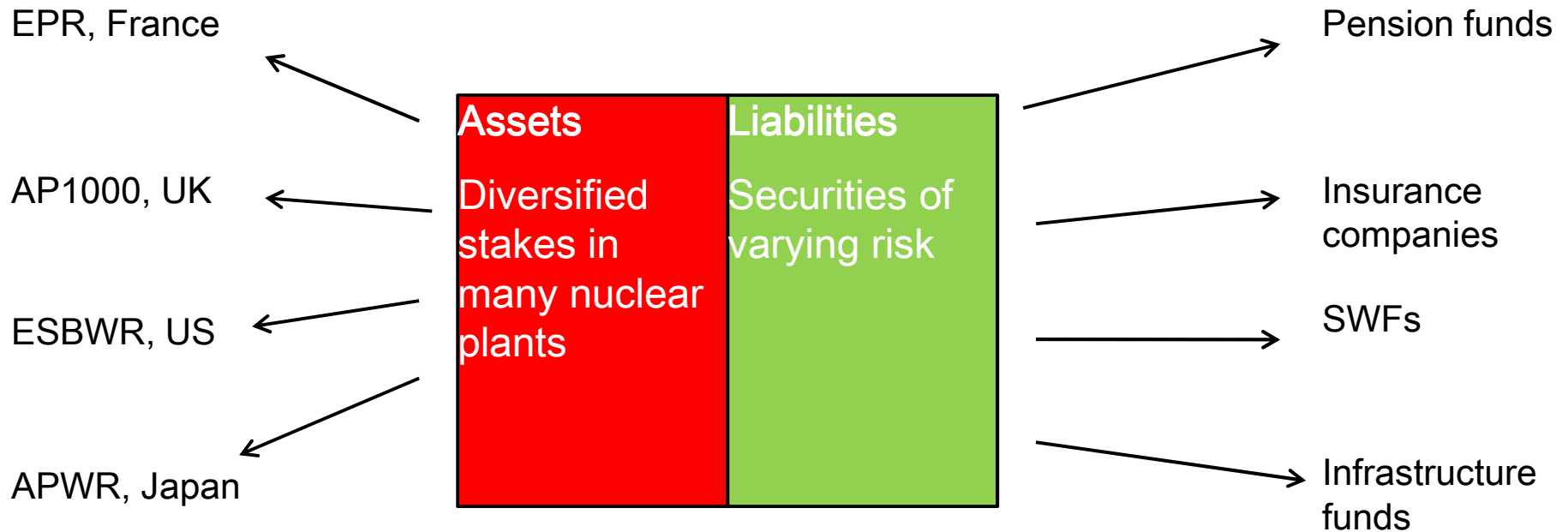
Pension funds: long term assets

How?

Securitise both equity and debt investments



# Illustration of a nuclear fund



Diversify by geography, technology and operator

BUT: retain nuclear event correlation risk



# Conclusion

Threats to financing:

- Re-regulation of finance

- Higher cost of capital, risk aversion

- Break down of international financial markets

- Bank capital depletion

- Competition with similar infrastructure financing

All would drive up cost of funds, possibly pricing nuclear out

But, assuming return to capital markets “normality” over medium term, no reason why nuclear shouldn’t become just another investment category.

