Financing CO_2 infrastructure: *A CCP2 case study*

Paul Zakkour, Principal Consultant, ERM Energy & Climate Change

IEA GHG CCS Financing Workshop, 28th May 2008, New York

Overview of work plan

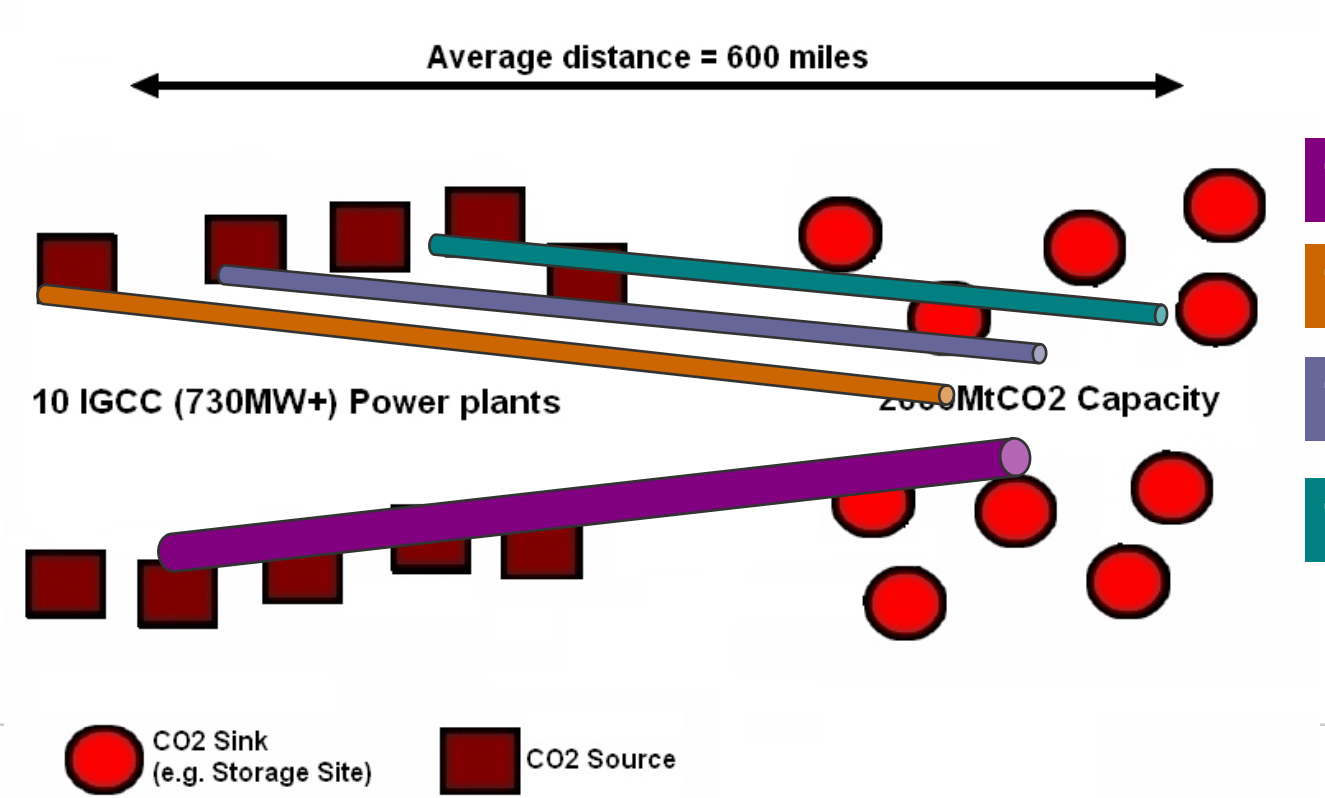
- **Aim:**
  - To assess financial aspects of building CO2 pipeline networks including backbone pipelines
- **Tasks:**
  1. Review O&G financing models via case studies
  2. Review public/private project financing models via case studies
  3. Assess simple business models for CO2 pipeline networks
  4. Interview financial service industry personnel on CCS financing perspectives

Assumptions and scenarios

Option 1:

Point to Point Pipelines

- **1 x 24 inch pipeline (tranche 1)**
- **3 x 18 inch pipelines (tranches 2, 3 and 4)**



Tranche 1

Tranche 2

Tranche 3

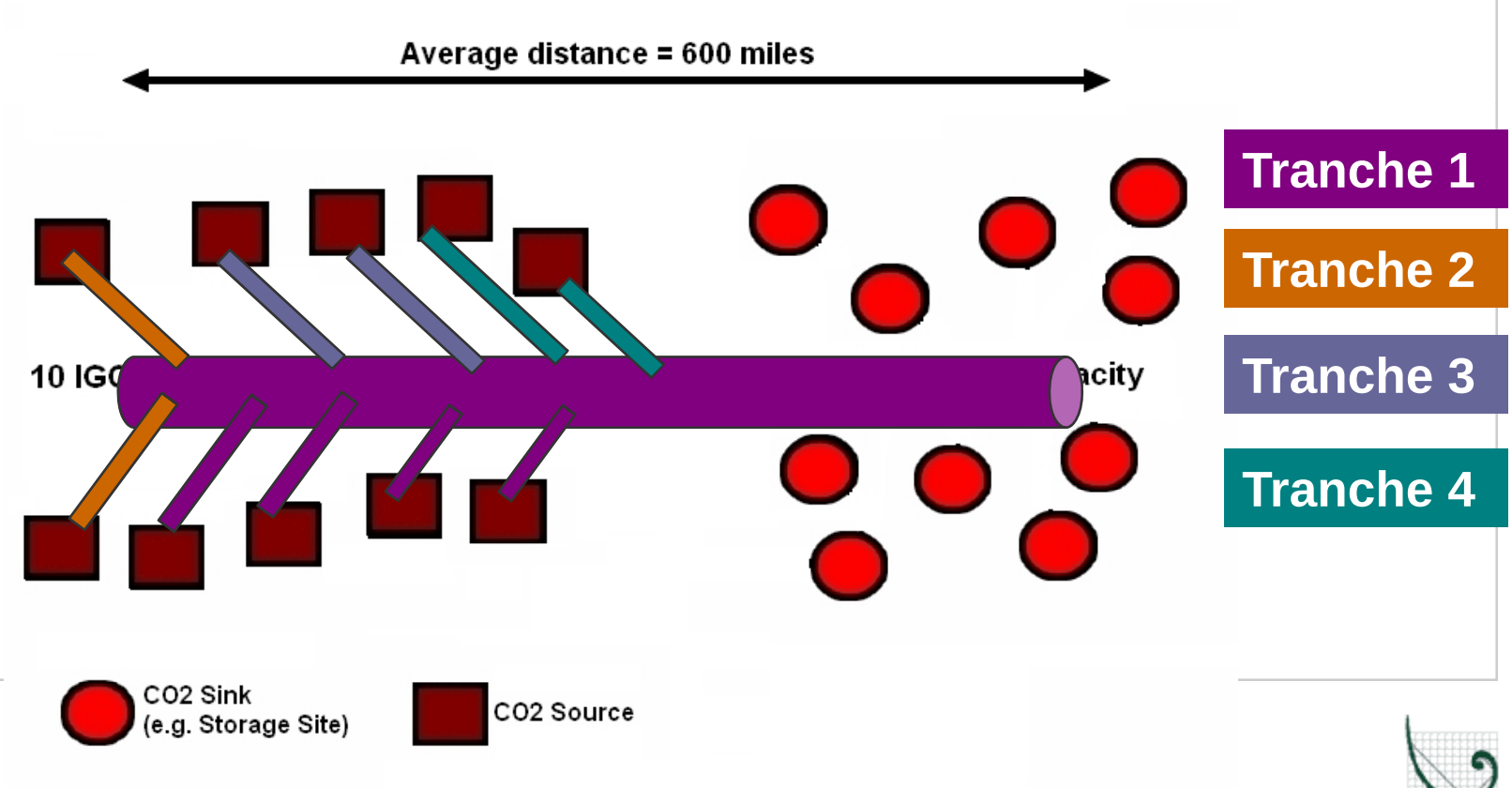
Tranche 4

Assumptions and scenarios

Option 2:

Backbone network

• 1 x 34 inch pipeline for all tranches



Tranche 1

Tranche 2

Tranche 3

Tranche 4

Assumptions and scenario

Project time length	**20 years (financial), 40 years (operational) (i.e. this does not influence cash flows and NPV)** ***Cost of service calculated for each option at zero 20 year NPV***
Cost of Equity	**15%**
Cost of Debt	**9.57% (Libor + 4%)**
Financing base case **Other casess**	**Base: 70% debt, 30% equity** **Balanced: 50% debt, 50% equity** **High Equity: 30% debt, 70% equity** **Public Private Partnership (PPP): 10% equity, 40% debt, 50% govt bonds** **Government Funding: (Govt guaranteed bonds 100%)**
CO2 Supply Scenario	**10 IGCC Power Plants (730MW+), connecting in 4 tranches:** **Yr 1 – 4 plants,** **Yr 3 – 2 plants;** **Yr 5 – 2 plants;** **Yr 7 – 2 plants.**
CO2 Pipeline Development Options/Scenarios	**1) Point-to-point pipelines: each tranche develops a pipeline at 98% utilisation.** **2) Backbone pipeline: the developer of tranche 1 develops network with the option for subsequent tranches to connect, to reach 98% utilisation**
CO2 Sink Scenario	**45 Injection wells in one or more geological formations (O&G fields) with total storage capacity ~2000 MtCO2**
Assumed Actual/Max Injection Rate	**1.1/1.3 MtCO2/yr**

1st mover disadvantage to build backbone

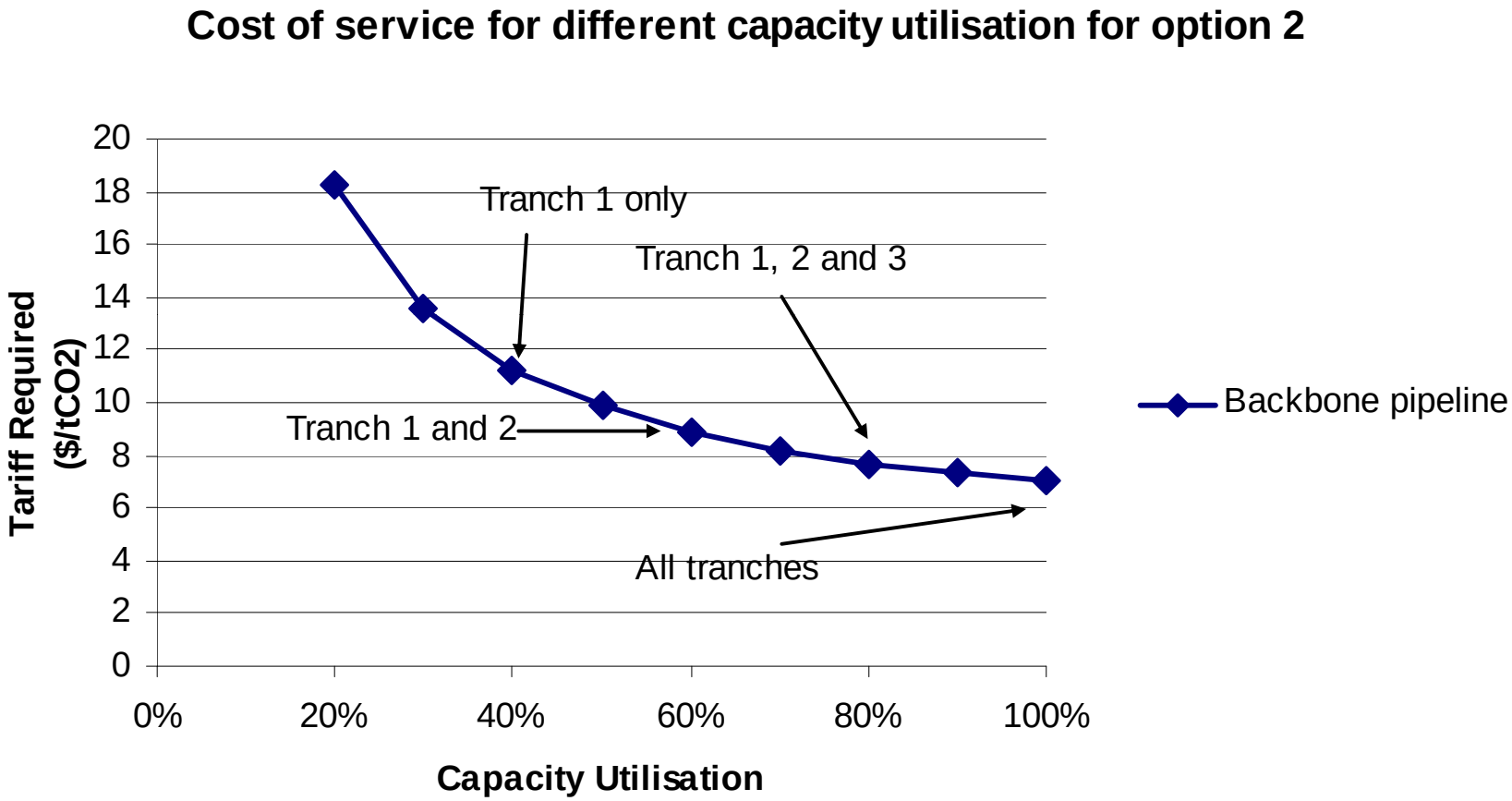
Pipeline option	Capex (for all tranches; $ M)	Capex required (in year 1; $ M)
Option 1 (point to point)	**$3,112.7**	**$1,030.9**
Option 2 (backbone)	**$2,321.8**	**$1,560.6**

Overall system development cost much higher for point-to-point deployment ($1.2 billion)

Significant capex burden on early mover (ie. Tranche 1) - $0.5 billion extra CAPEX required

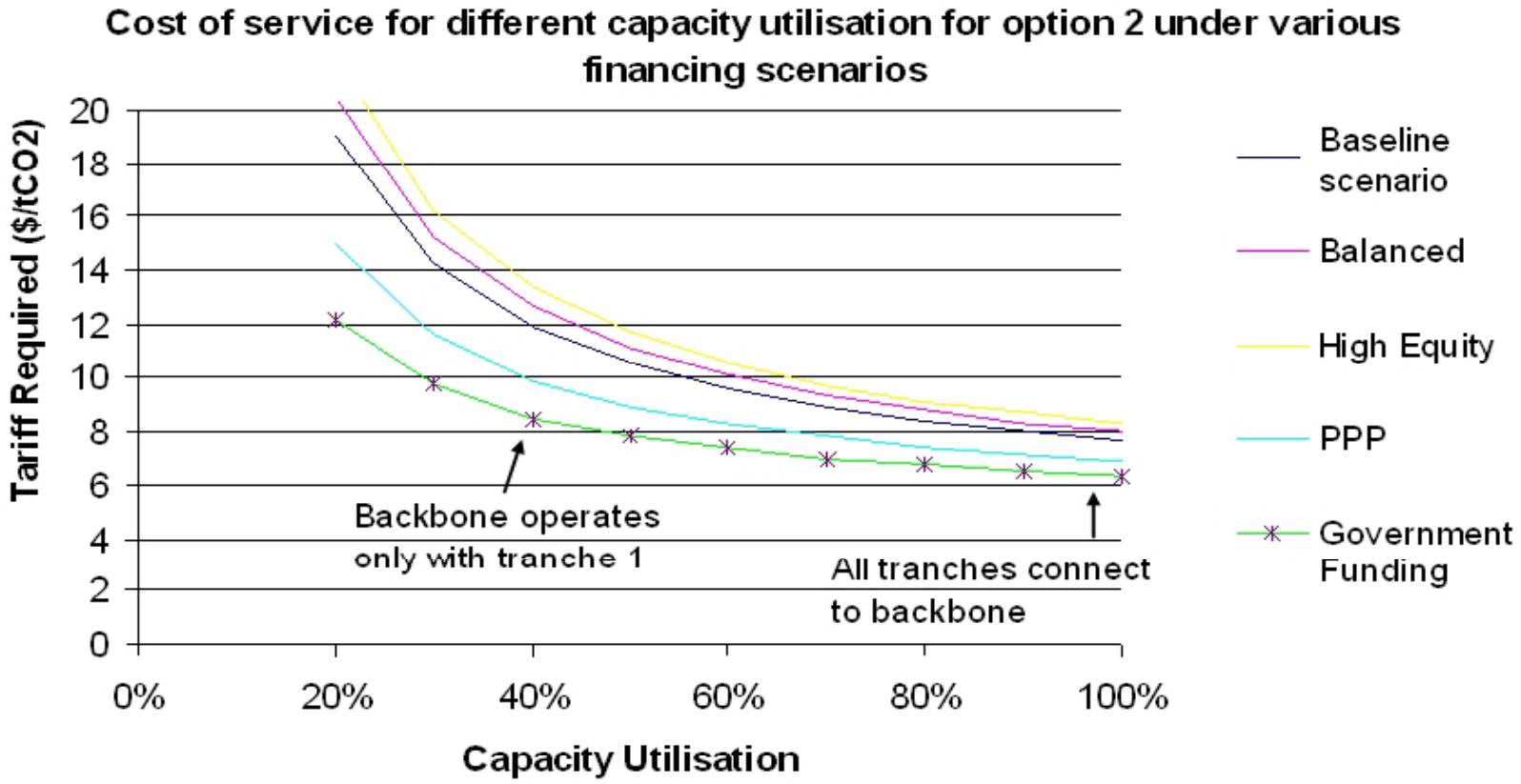
Significant additional capital costs imposed on first mover (i.e. tranche 1), which could affect financing capability

Sensitivity to reduced capacity utilisation



If later tranches are not realized, significant risk for early mover. Cost of service much higher ($11.3)

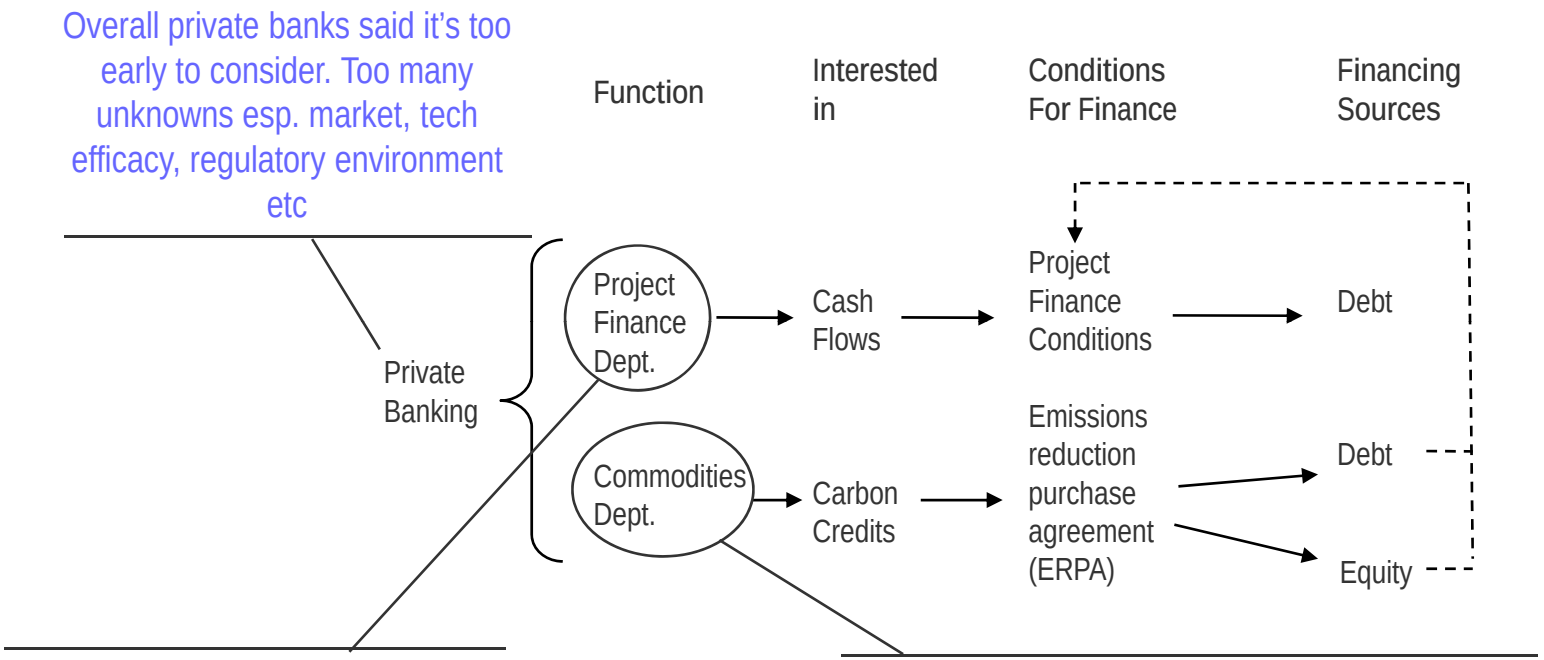
Sensitivity – alternative financing mech's



Altering funding approaches can change cost of service and reduce risk for early mover (e.g. govt funding reduces cost of service to $8.2 for just Tranche 1 with the Option 2 (i.e. only 4 plants connected to the backbone)

Investor perspectives – private banks

Overall private banks said it's too early to consider. Too many unknowns esp. market, tech efficacy, regulatory environment etc

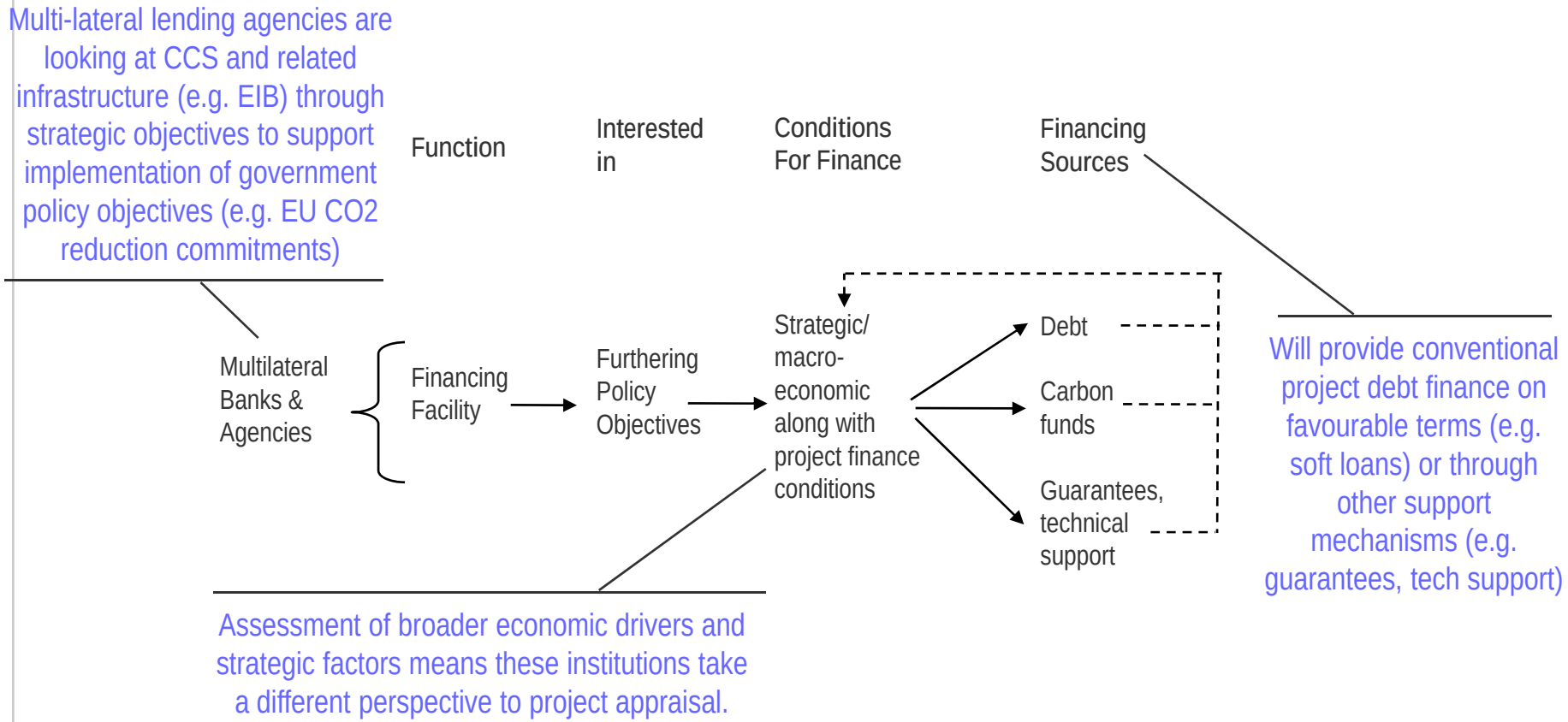


Project finance depts. have project finance drivers (e.g. debt repayment and cash flows). Would apply standard project finance metrics (e.g. NPV etc.).

Commodities depts. will have strategic drivers. Take equity in asset to secure commodity take-off and trading (e.g. do already for LNG terminals; coal transporters). BUT, will require debt finance to support this

Pure project finance may be applicable as market and technology evolves. Risk may be reduced through equity interest from investors for credit offtake

Investor perspectives – multilateral lenders



Ready to finance CCS demonstration plants and other experimental clean coal technologies (primarily as RDI projects) provided they meet environmental, economic, technical and financial criteria, including credit risk criteria.

Key messages

- **Integrated backbone pipeline networks may be most efficient long-term option.**
  - Will need "guaranteed" capacity utilisation in order to be economically viable.
  - Point-to-point pipelines will be funded on project-by-project basis by individual developers because of certainty over capacity utilisation.
- **Public policy that encourages development of optimised networks will be needed.**
  - Government incentives, loan guarantees will support with commercial appraisal of backbone infrastructure
  - Government support in first years when capacity is ramping up will be important to commercial viability
- **CO2 pipeline projects, if they can be reduced in terms of carbon price risks, will become the same in terms of risks as any other oil & gas pipeline project**
- **Banks and financial institutions view such projects as having significant regulatory and market (carbon price) risks.**

Financing CO_2 infrastructure: *A CCP2 case study*

Paul Zakkour, Principal Consultant, ERM Energy & Climate Change

Email: paul.zakkour@erm.com

Tel: +44 20 7465 7200 (London)

ERM Climate Change (North America)

Email: lisa.campbell@erm.com

Tel: +1 919-233-4501 (Raleigh)