
CO₂ capture and storage costs

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CO2CRC Participants



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Australian Greenhouse Office

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Collaborating with

- Canada
- China
- EU
- Japan
- UK
- USA

Perth

Adelaide

Melbourne

Sydney

Canberra

Brisbane

Wellington



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Measurement

Variability

Uncertainty

Source-to-sink economics

Sources

Power stations, gas fields, metal making, refineries, petrochemical plants.

Sinks

Saline aquifers, depleted fields, coal seams.

**Our economics covers the whole system.
We look at source-to-sink / end-to-end costs**



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Definitions

Capture = separation

Storage = compression, transport and
injection

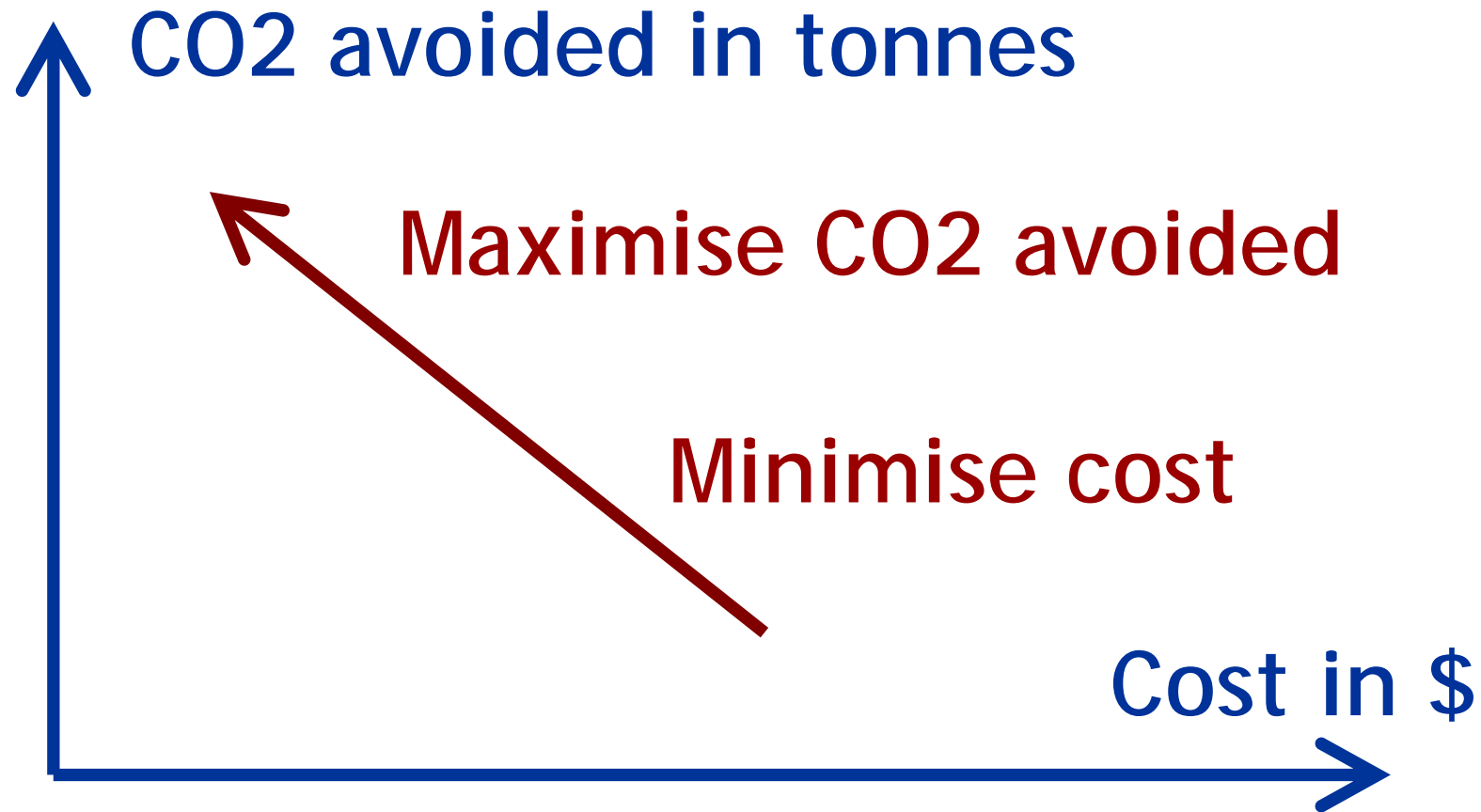
But really it is one integrated system



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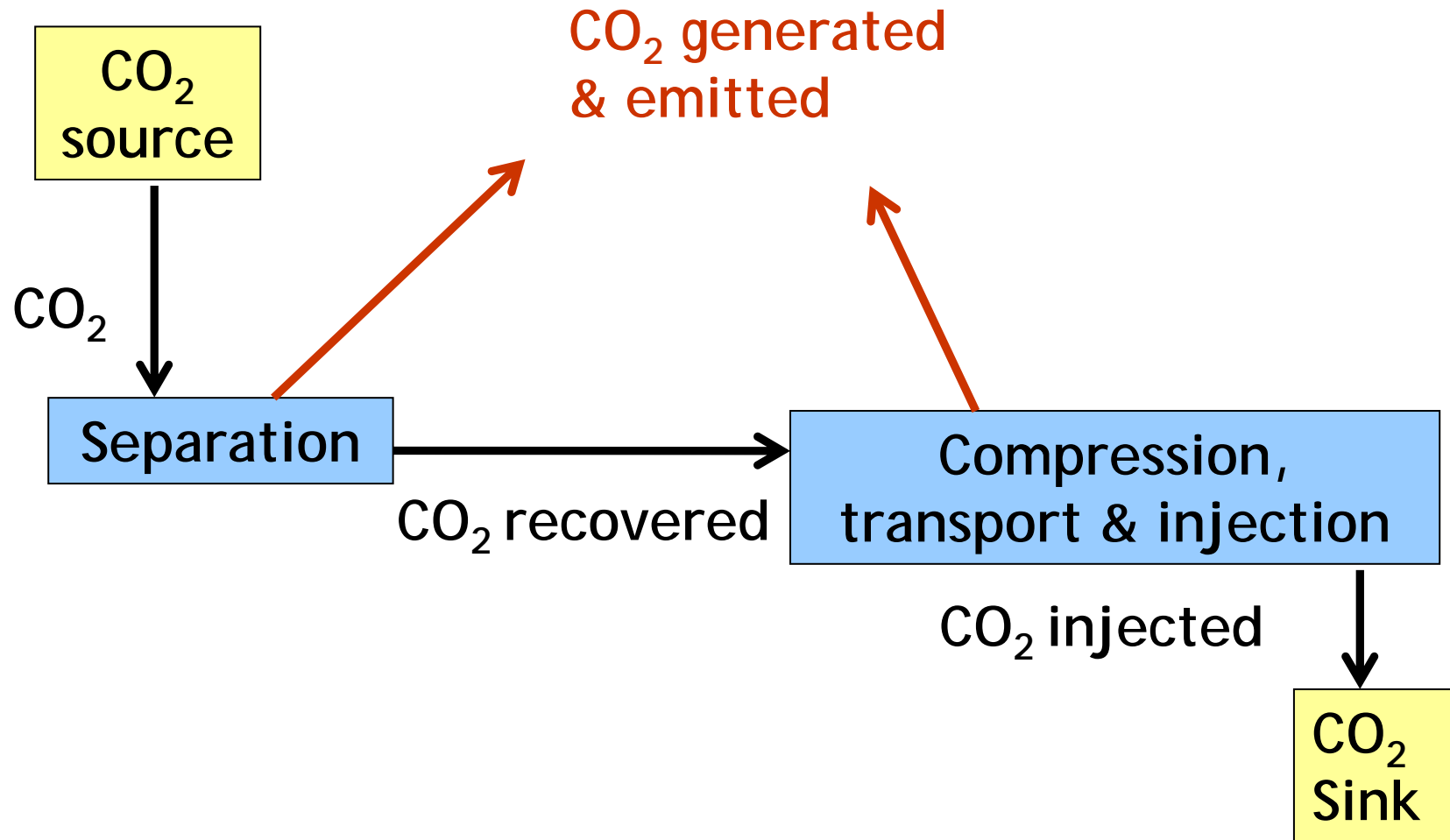
Economic variables



CO₂ avoided

CO₂ avoided

CO₂ flow



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Defining CO₂ avoided (not to scale)

CO ₂ feed gas		
		CO ₂ emitted
CO ₂ recovered & injected		
	CO ₂ generated	
CO ₂ avoided		



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\$ per tonne of CO₂ avoided

Costs in
\$ per CO₂ avoided

CO₂ example - assumptions for hypothetical case

	Units	Total	Yr 1	Yr2	Yr3	Yr ...	Yr 22
Capex	US\$MM	680	340	340	0	0
Opex	US\$MM	2,800			140	140
Revenue (EOR, CBM)	US\$MM	0			0	0
CO ₂ avoided#	MM tonnes	60			3	3

Inject 5 MM tonne per year

Present Value (PV) of costs

Yr 1	Yr 2	Yr 3	Yr 4 ...	Yr 21	Yr 22
Capex	Capex	CCS	CCS	CCS	CCS

- ← PV of capex
add
- ← PV of annual opex
equals
- ← PV of total costs
divided by
- ← PV of annual CO₂ avoided
equals
- PV of total costs / tonne

\$ per tonne avoided for example case

Real NPV capex	US\$614 MM
Real NPV opex	US\$1,285 MM
NPV CO₂ avoided	28 MM tonne
Real cost per tonne avoided	US\$68 per tonne

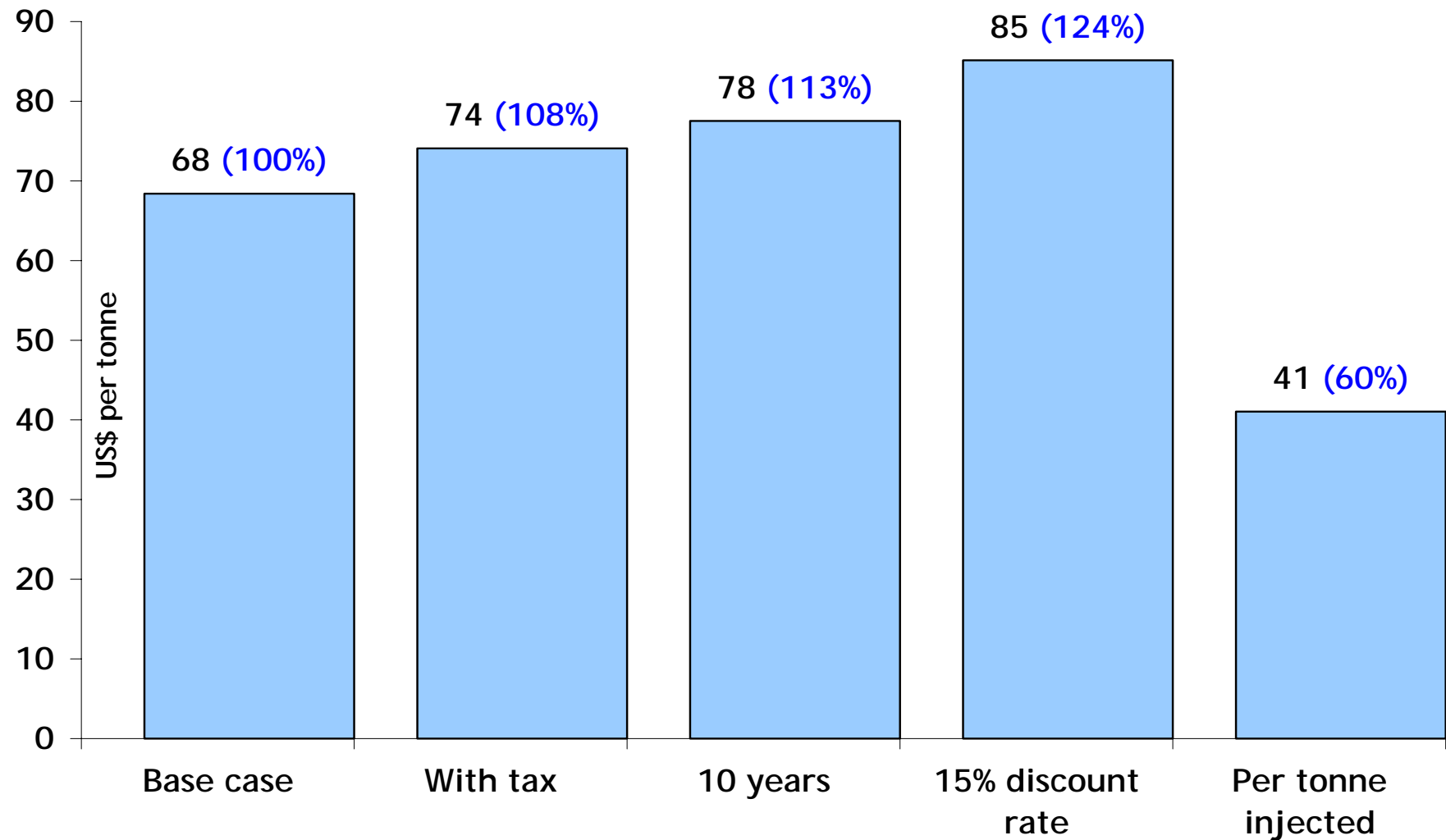
Assumes

Inject for 20 years

Real discount rate 7%

No tax

\$ per tonne with different economic assumptions



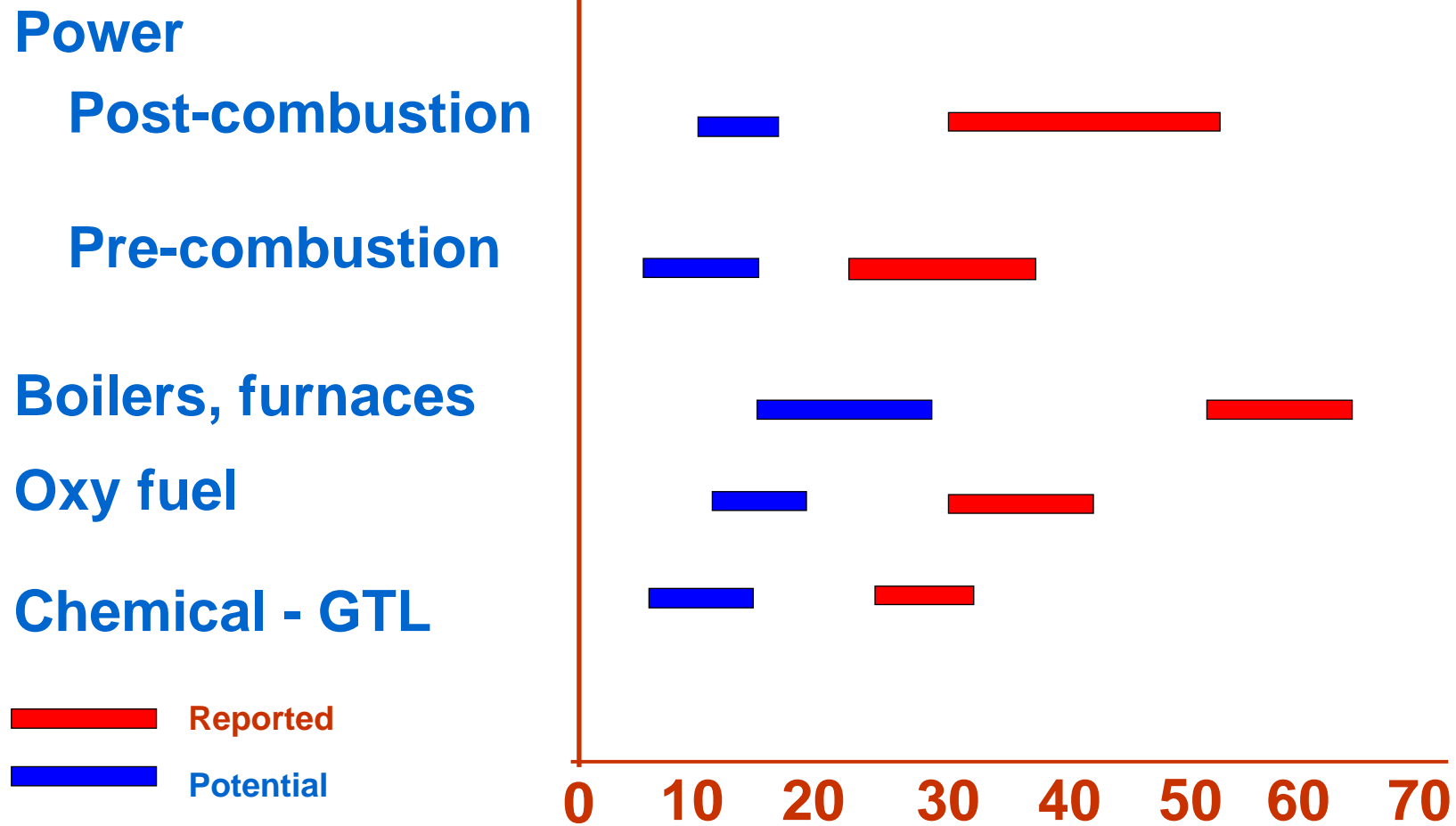
\$ per tonne CO₂ avoided

Conclusion
\$ per tonne
of CO₂ avoided
depends a lot on our
economic assumptions

Variability

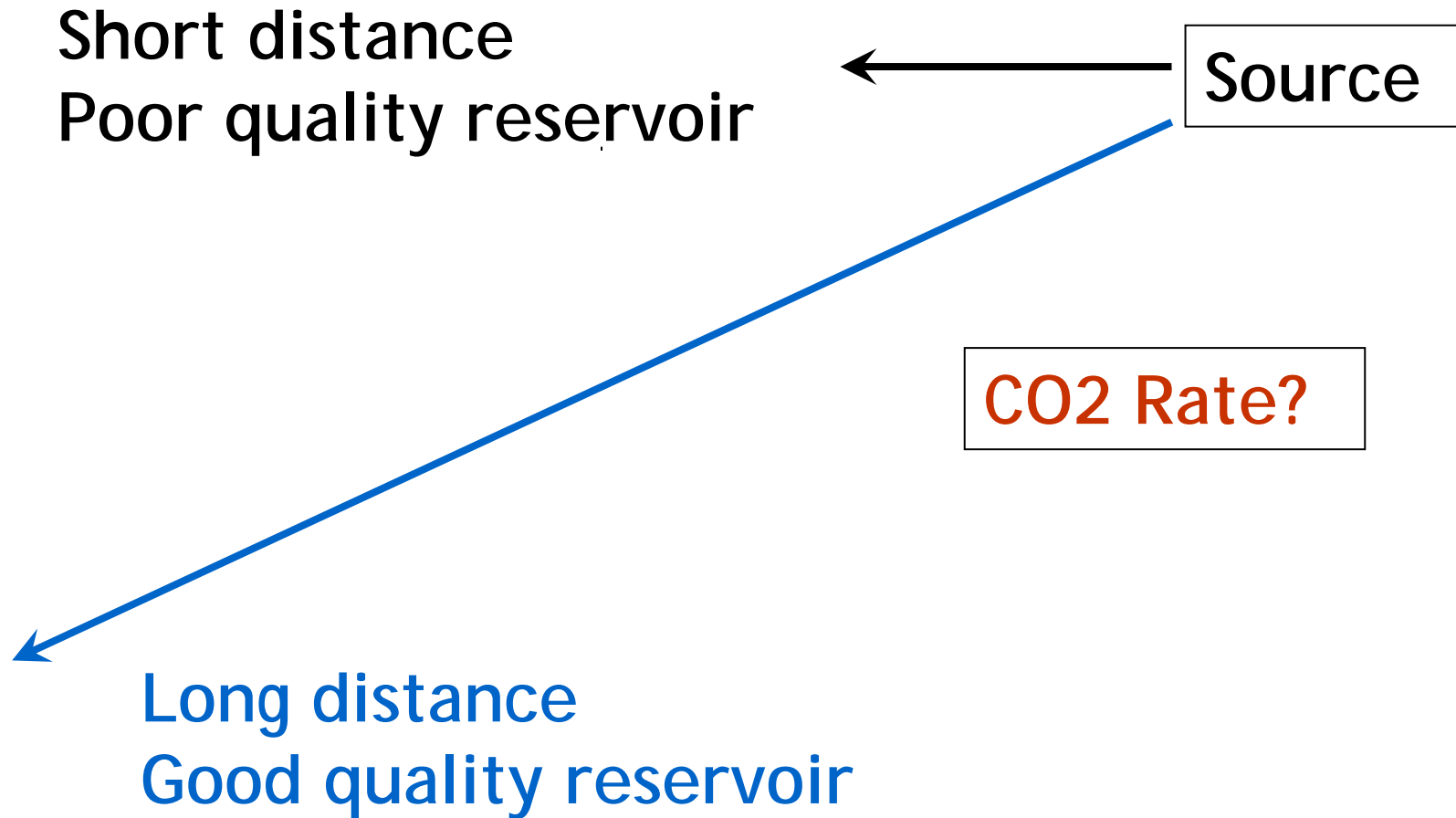
Variability

Variability in capture cost - \$US/tonne avoided *



* Usually includes compression after separation

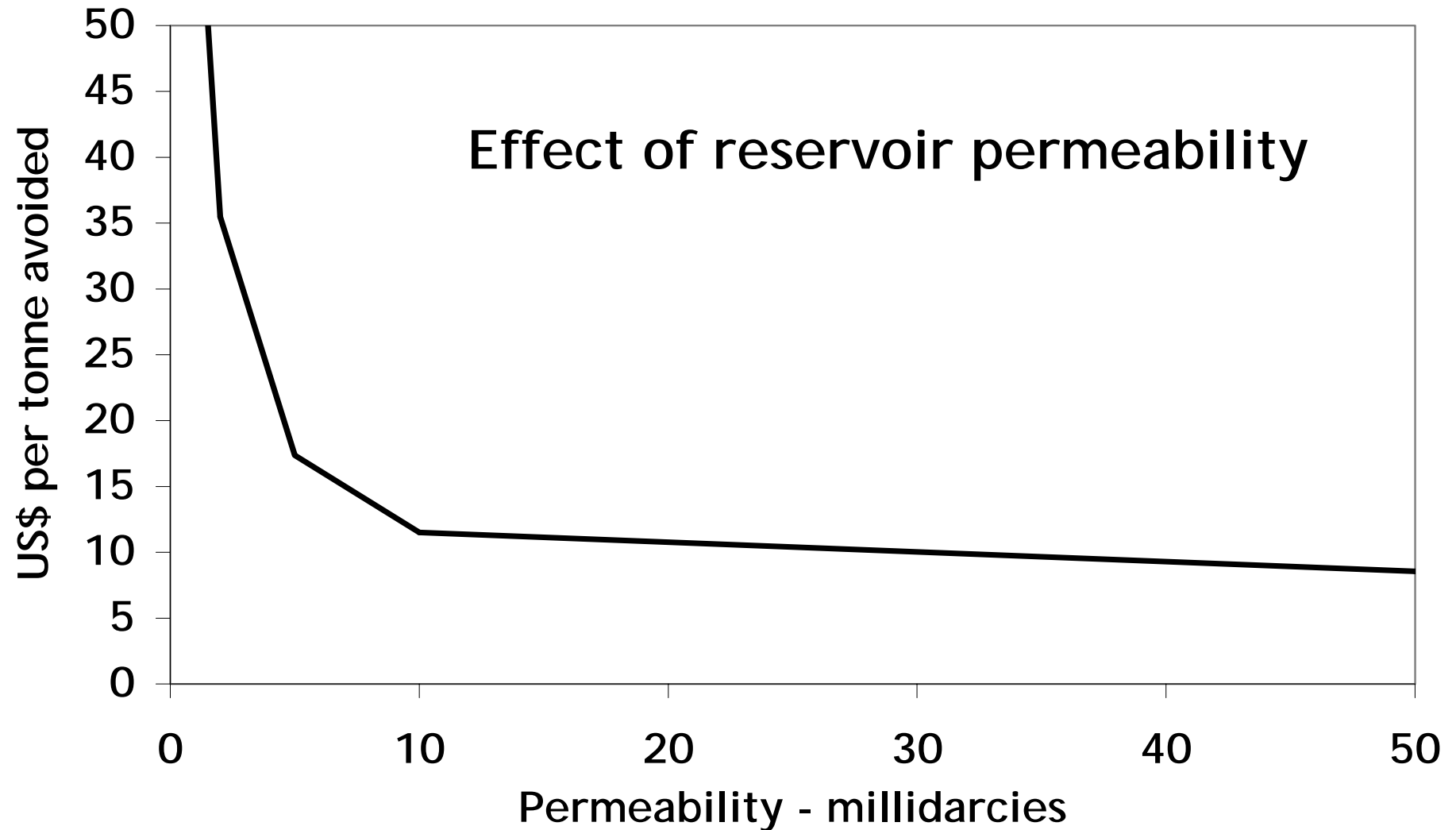
Variability in storage costs - options



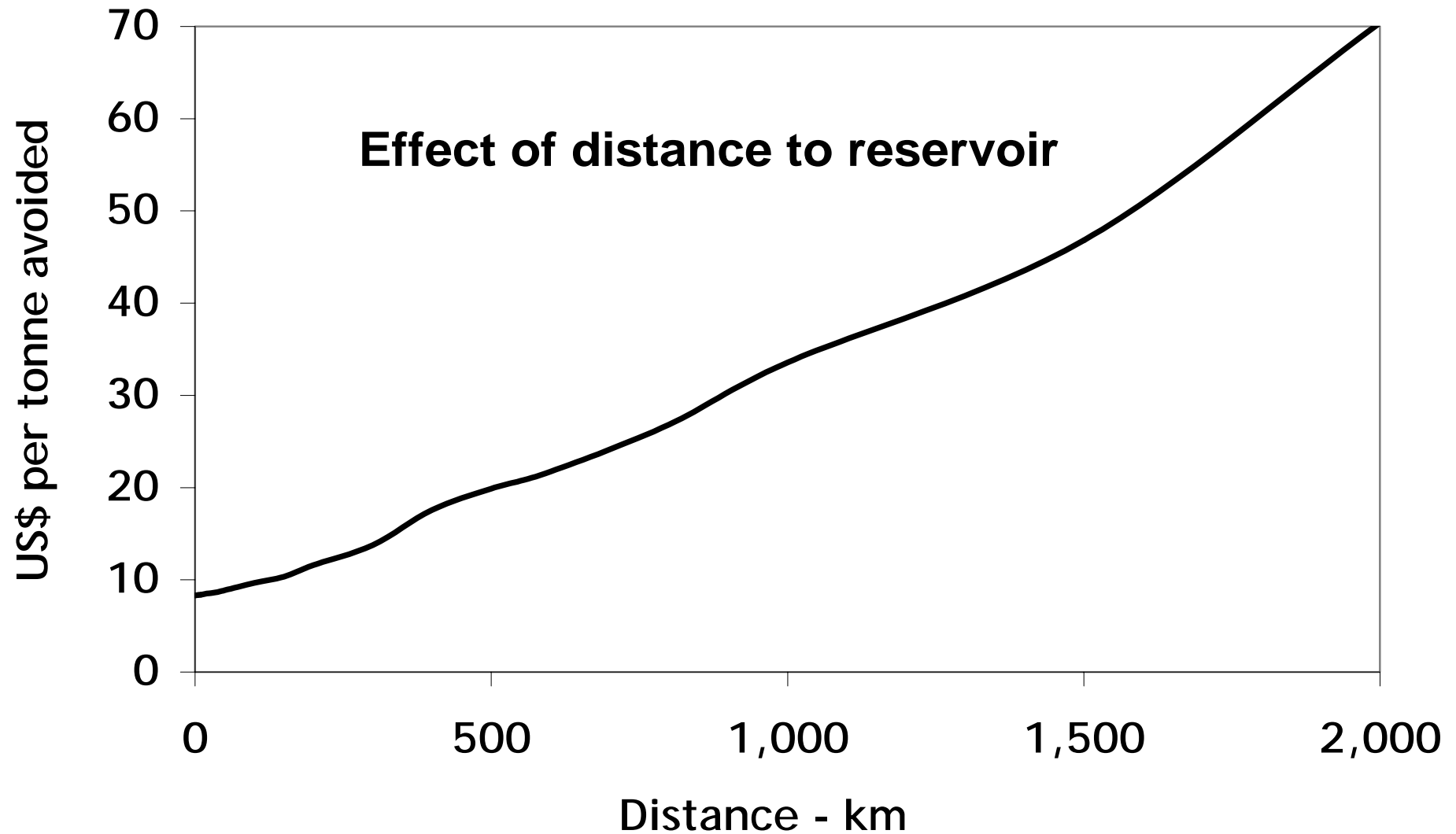
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Effect of reservoir parameters on storage costs - illustration



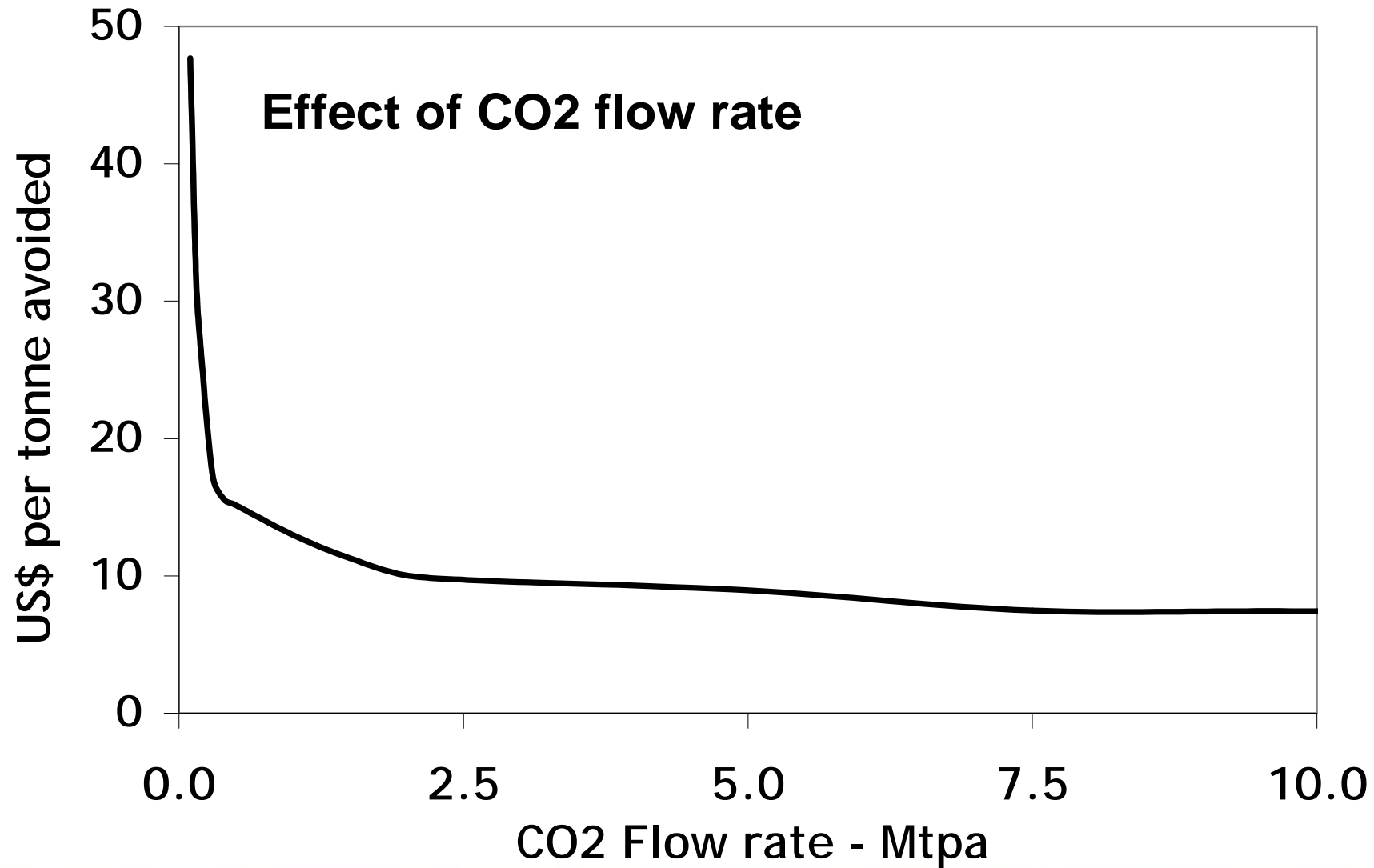
Effect of distance on storage costs - illustration



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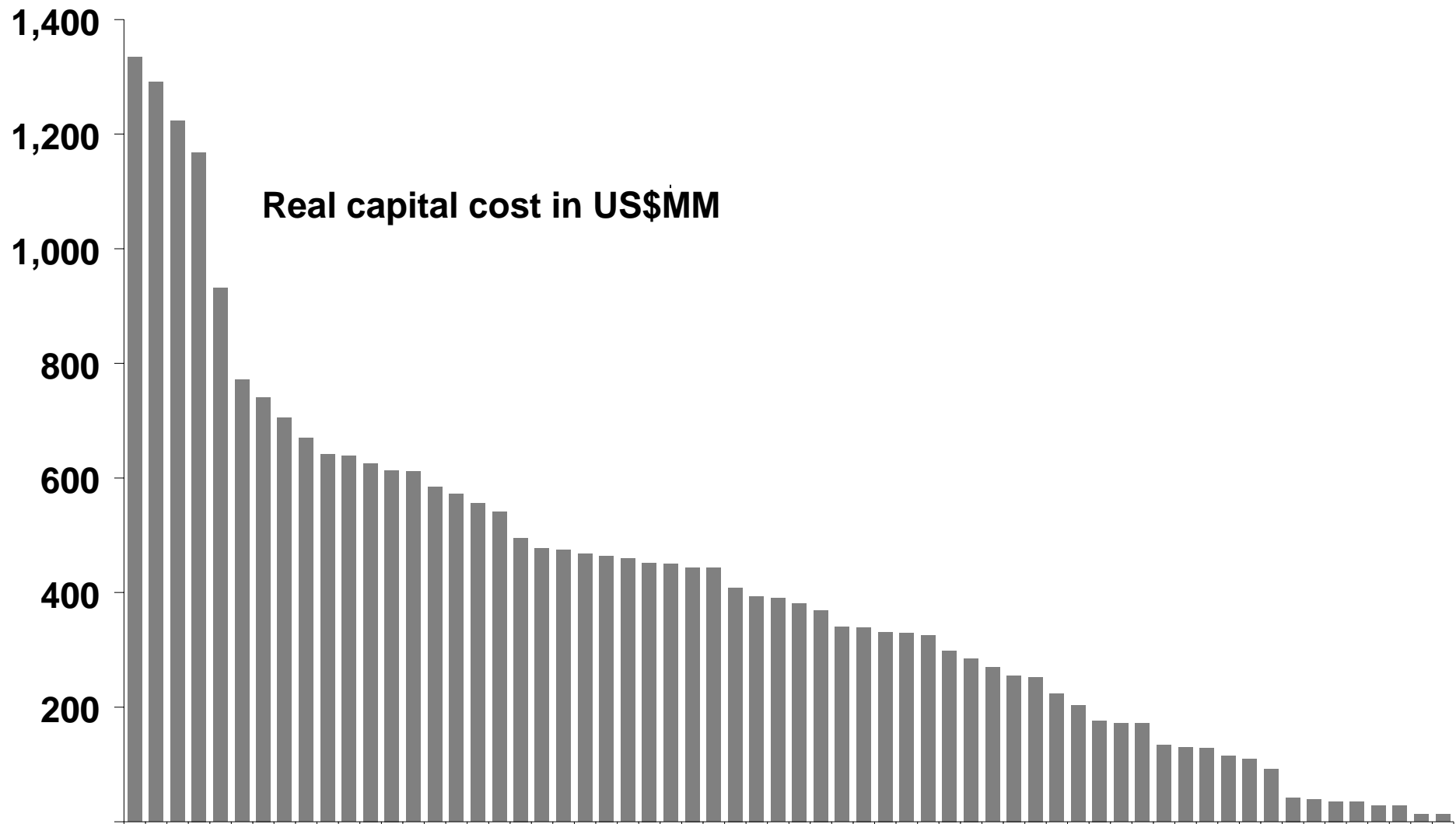
Effect of rate on storage costs - illustration



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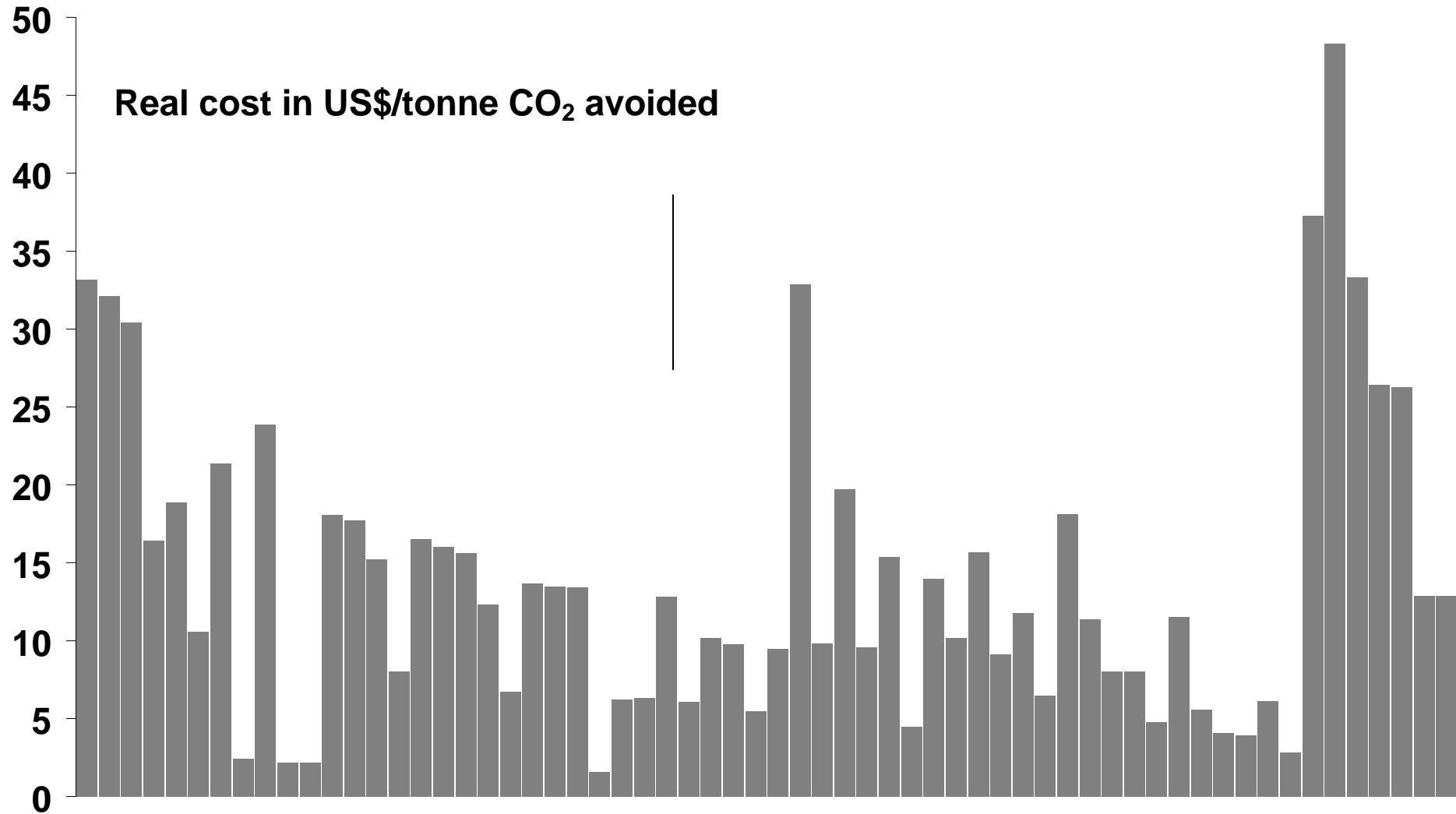
Variability in storage capital costs for Australian sinks



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Variability in storage costs



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Capture and storage costs in \$US/tonne avoided

Reported capture costs



Potential capture costs



Storage costs



US\$ per tonne avoided

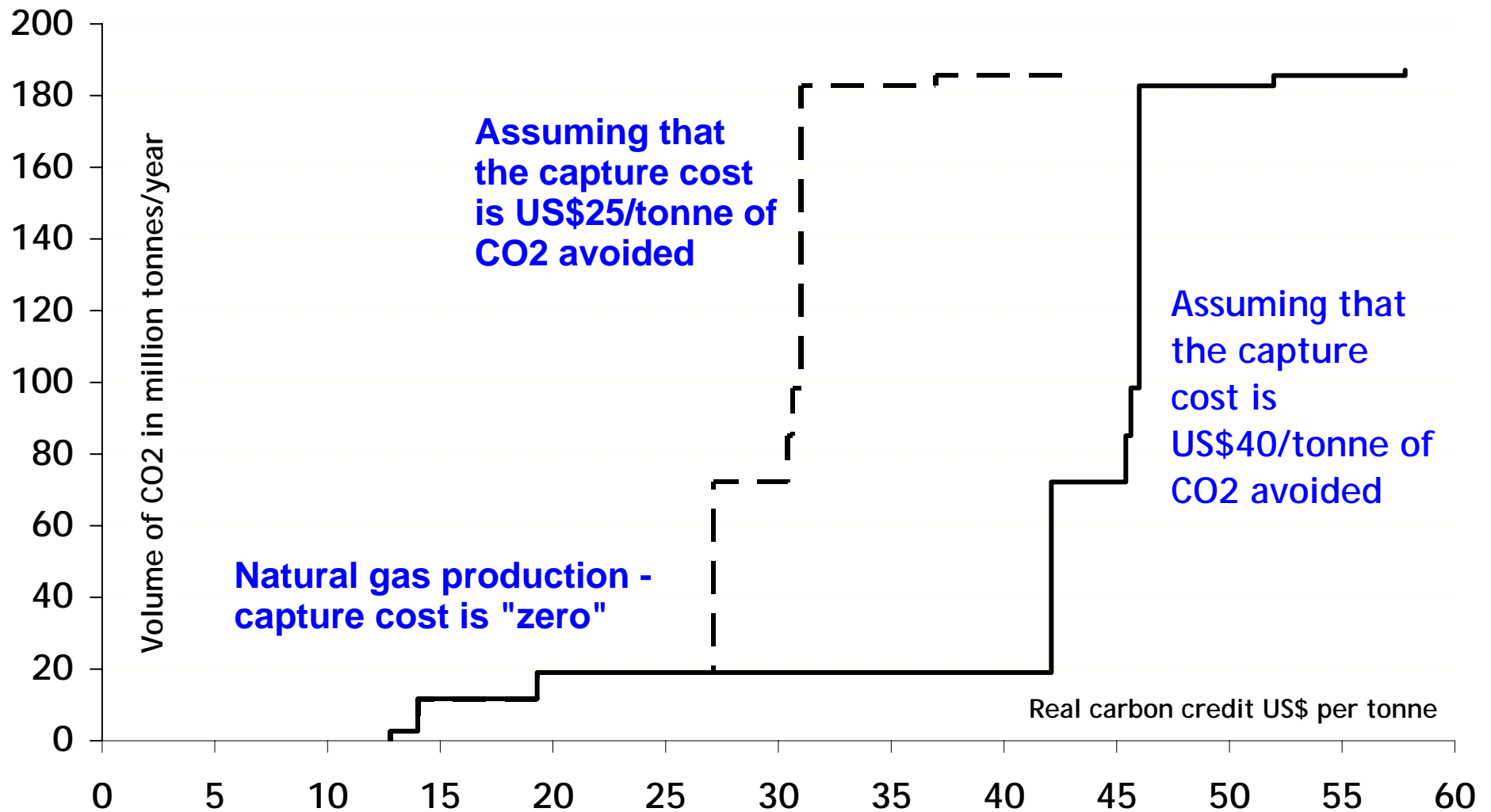
0 10 20 30 40 50 60 70



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Cost curve for Australia



Conclusions

End-to-end costs depend on the nature of both the source and the sink.

The amount of CO₂ we store economically depends of the level of the carbon credit



Uncertainty

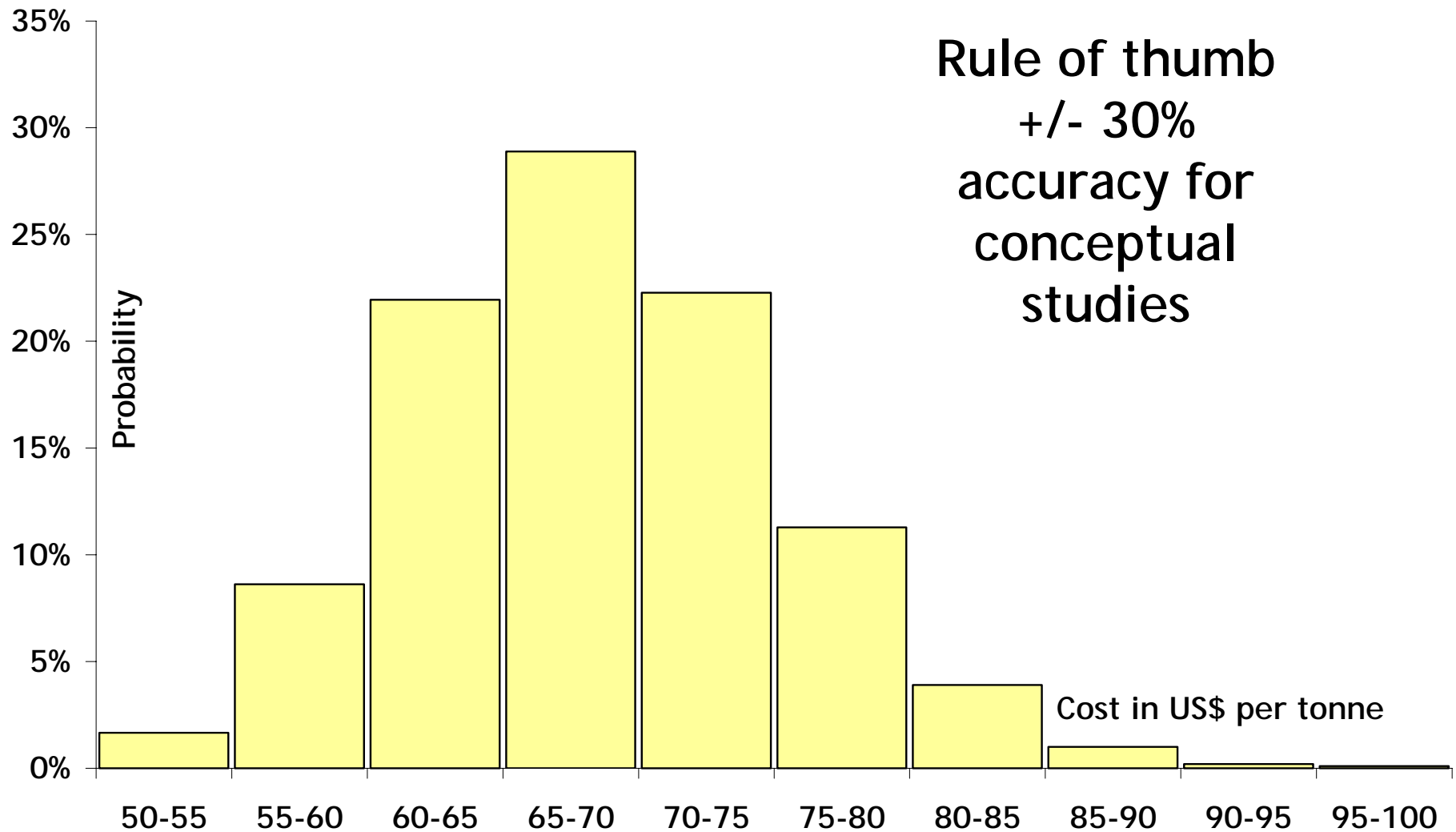
Uncertainty



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Uncertainty



Conclusion

Even when we fix our
economic assumptions
and the source and sink,
the costs are uncertain



Summary

It is the total end-to-end cost that matters

What are the assumptions?

What is the specific case?

Remember uncertainty



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Thank you

