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Energy infrastructure scenarios for the UK: are they resilient?

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IIESI Conference, NREL, Denver, 5-6 December 2017

Outline

- Project rationale
- New UKERC scenarios
- Indicator framework
- Selected results
- Emerging conclusions

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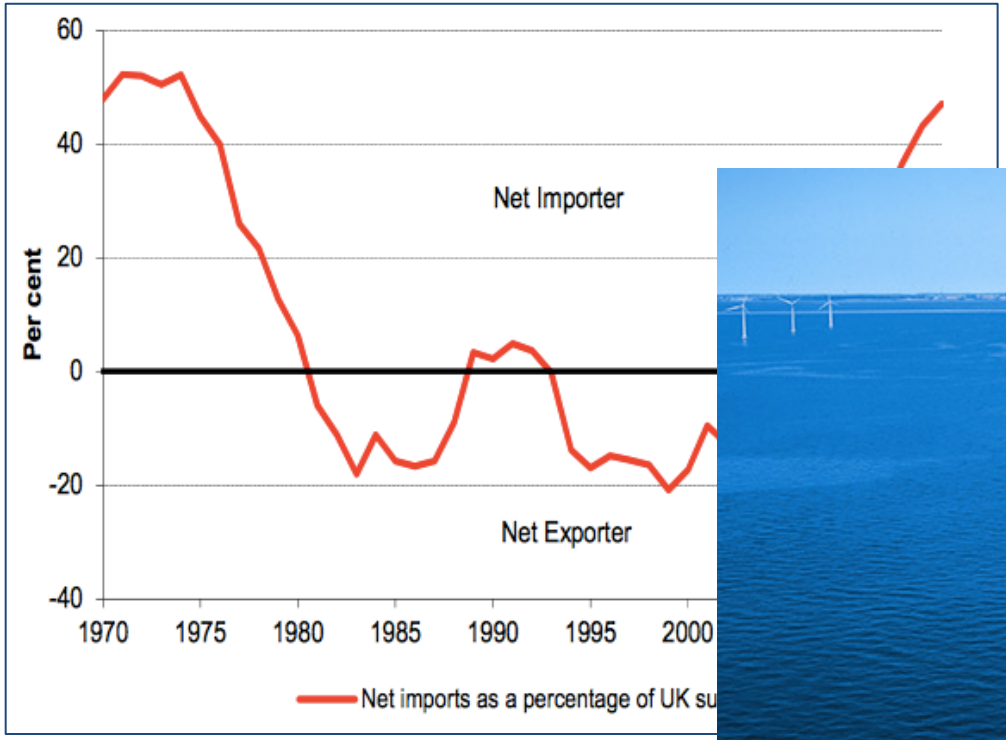
Rationale



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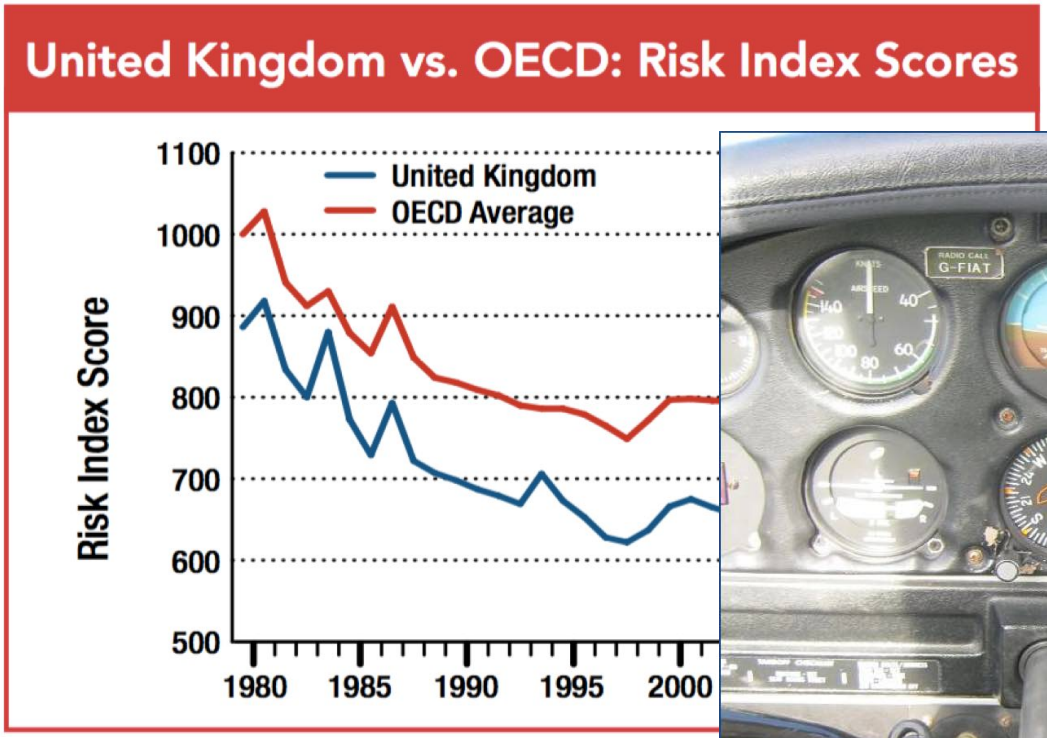
Dashboard approach



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2017 UKERC energy scenarios

UK climate policy	Strong commitment to meeting targets	Policy commitment falters: 4th carbon budget only	Climate legislation repealed: 3rd carbon budget only
UK governance	Centralised decision-making at UK level	Decisions shared: central, devolved, local government	Centralised decision-making; Scottish independence
UK economic policy	Small state; weak approach to infrastructure	Selective state action; co-investment in infrastructure	Active state; high infrastructure co-investment
Relationship with the EU	The UK stays in the EU	The UK leaves the EU but has significant single market access	The UK leaves the EU with poor access to single market

Energy island
Low carbon no BECCS
Low carbon no CCS
Slow Decarbonisation
Low carbon
Tech optimism

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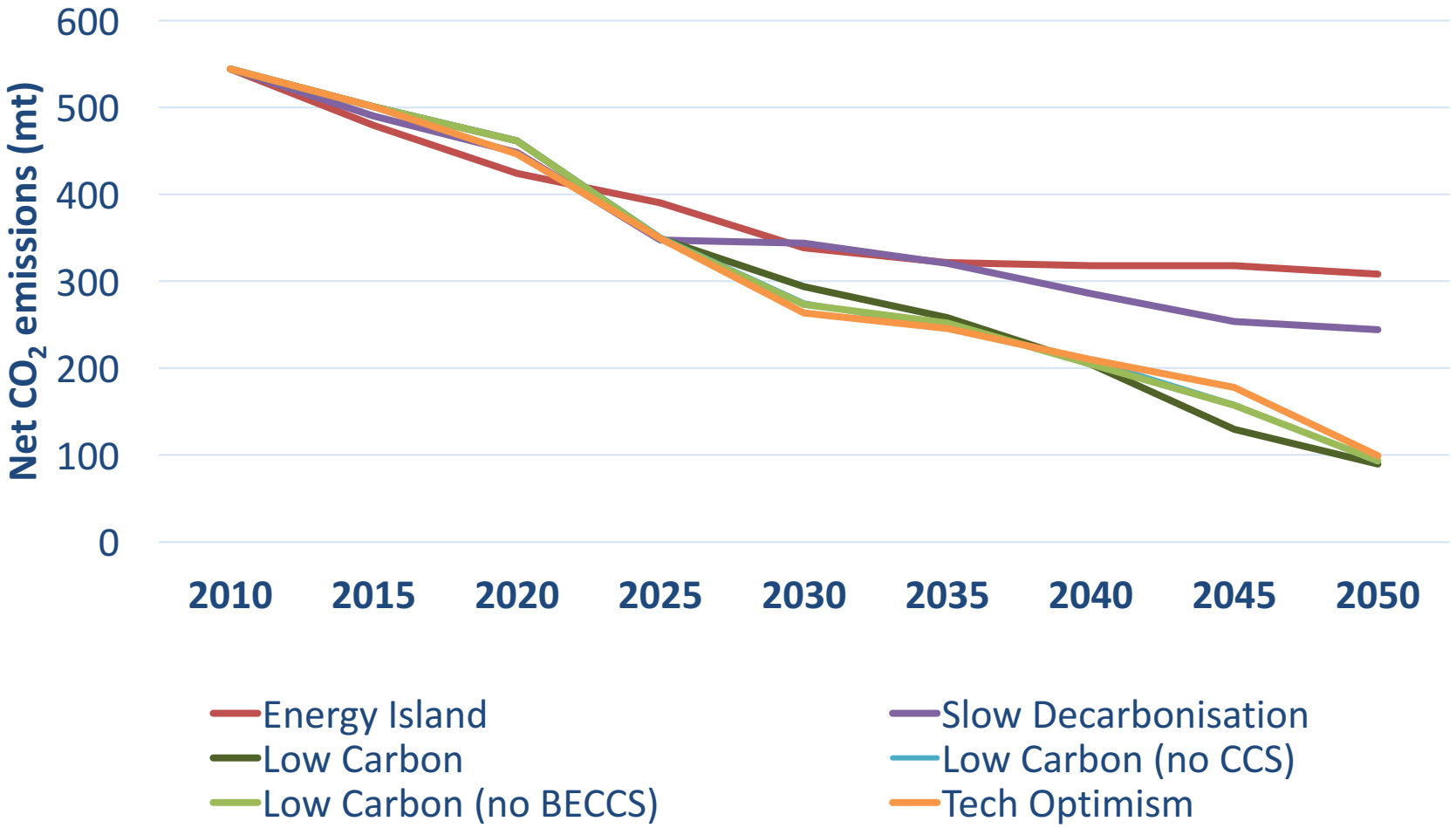
2017 UKERC energy scenarios



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Indicator dashboard

Source: Emily Cox PhD thesis (2017)

Summary dashboard
2050 vs 2016

	Energy island	Slow decarb	Low carbon	Low carbon (no CCS)	Low carbon (no BECCS)	Tech optimism
Energy diversity	↑	↑	←	↑	↑	←
Electricity diversity	←	↑	↑	↓	←	↑
Public opposition (elec)	←	↓	↓	↓	↓	↓↓
Oil imports	↓↓	↑	←	↓	↓	↓
Biomass imports	↓	↑	↑	↑	↑	↑
Gas imports	↓	↑	↑	↓↓	↑	←
Gas LOLE	←	↑	↑↑	←	←	←
Electricity LOLE	↑	↑	↑↑	↑↑	↑	↓↓
Interconector capacity	←	↑	↑	↑	↑	↑

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Summary dashboard
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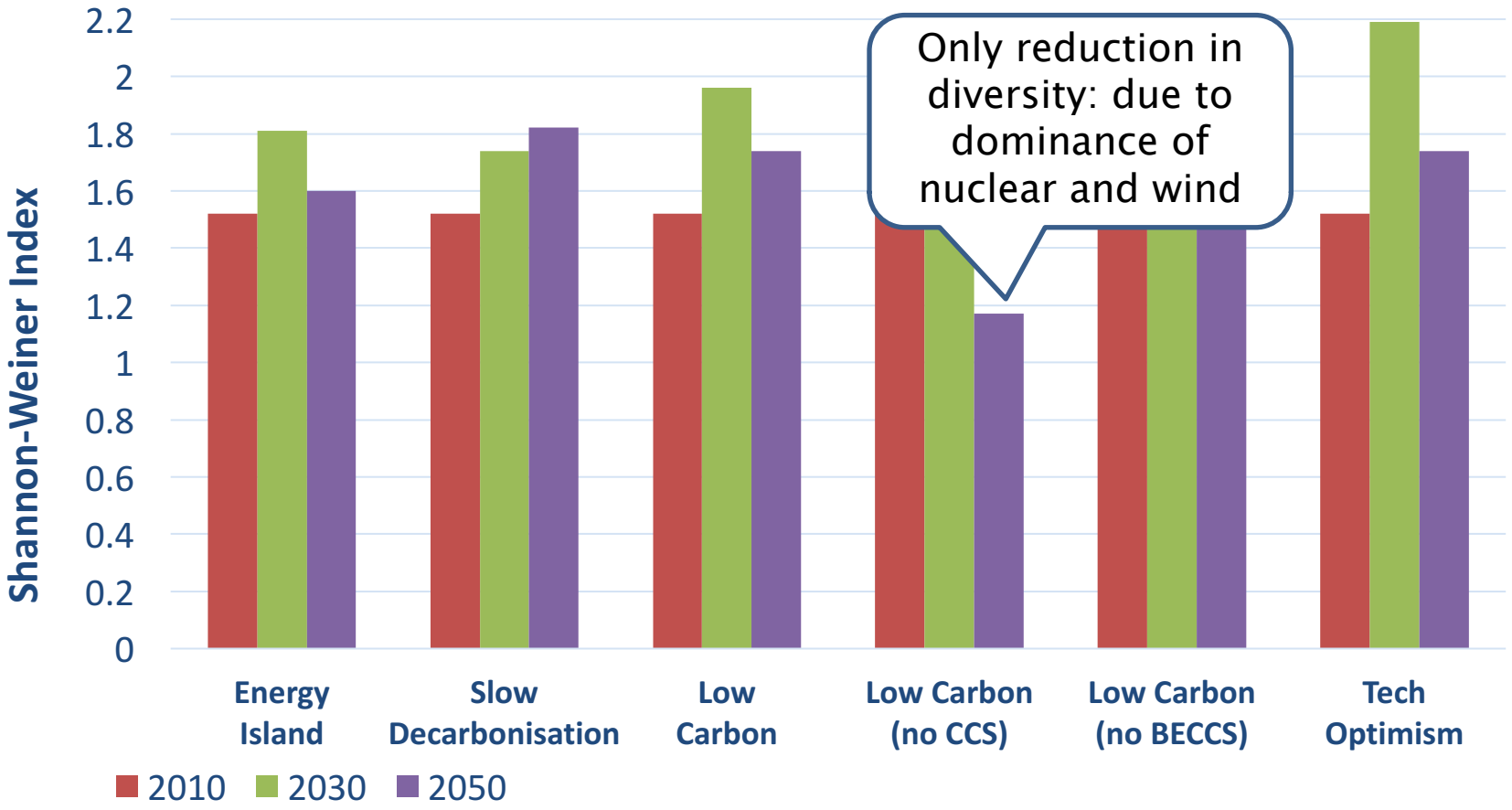
Availability indicators
Electricity diversity



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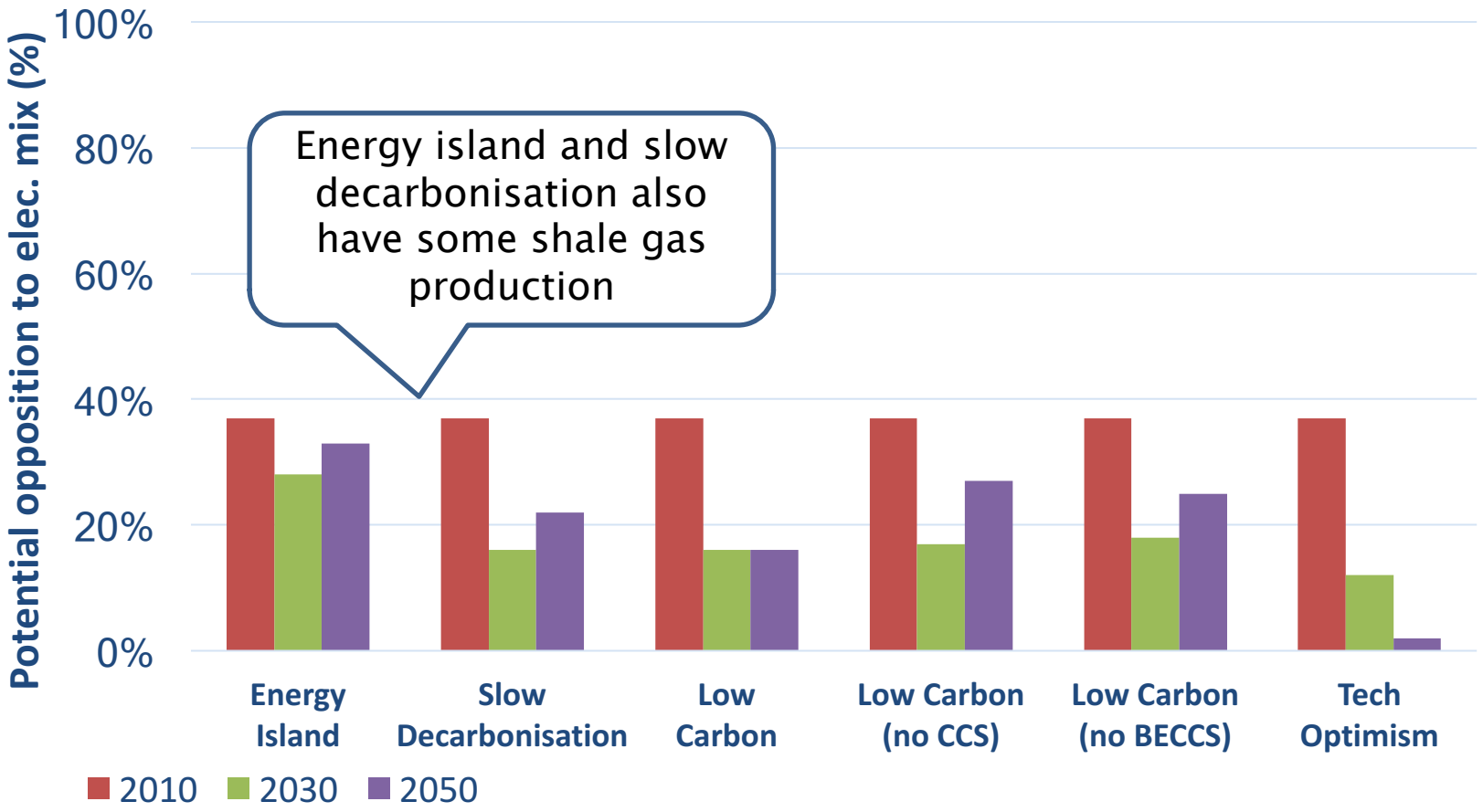
Availability indicators

Potential public opposition to electricity mix



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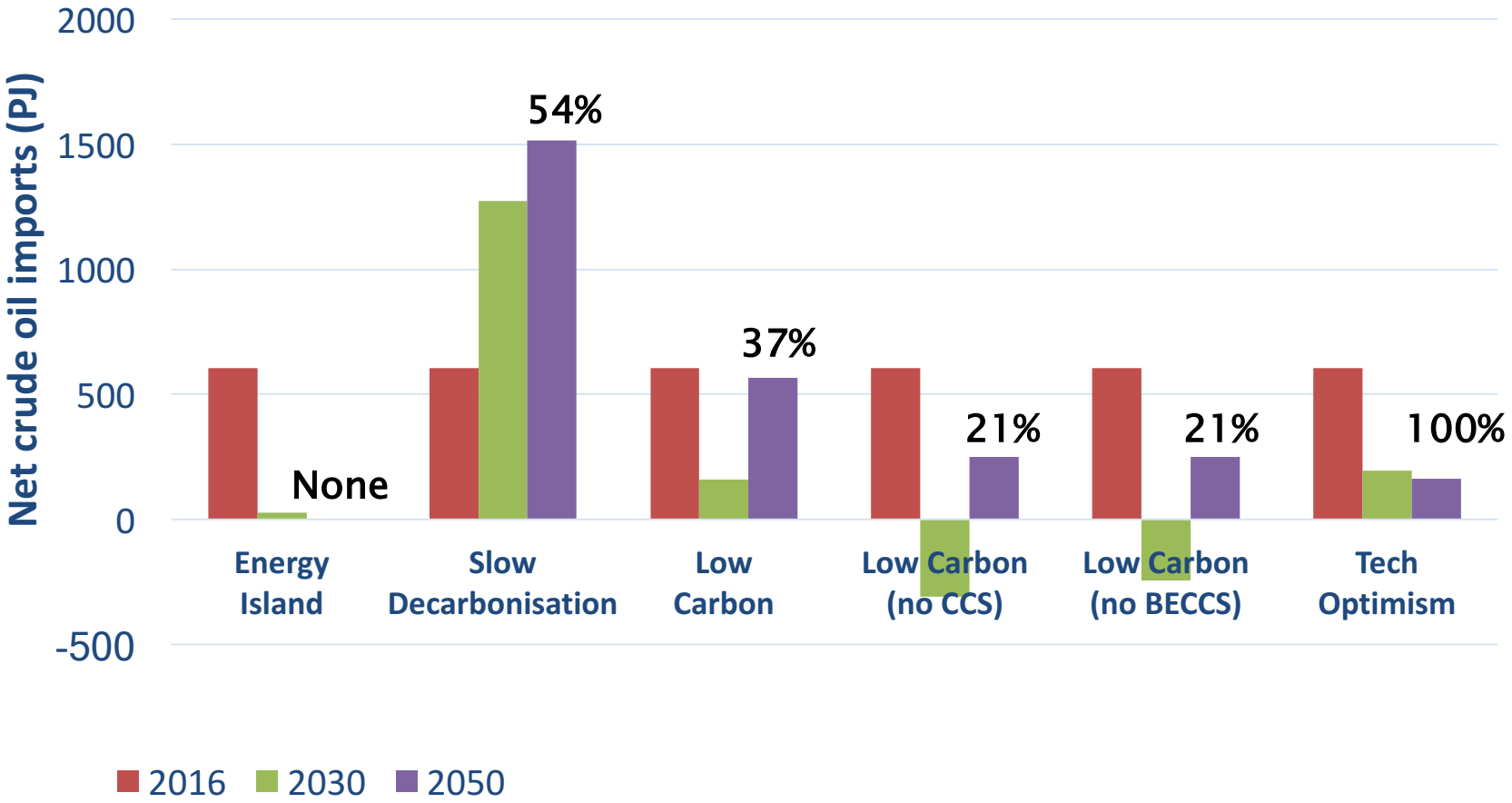
Availability indicators
Crude oil imports / demand



Net imports in 2050 as % of consumption (2016: 17%)

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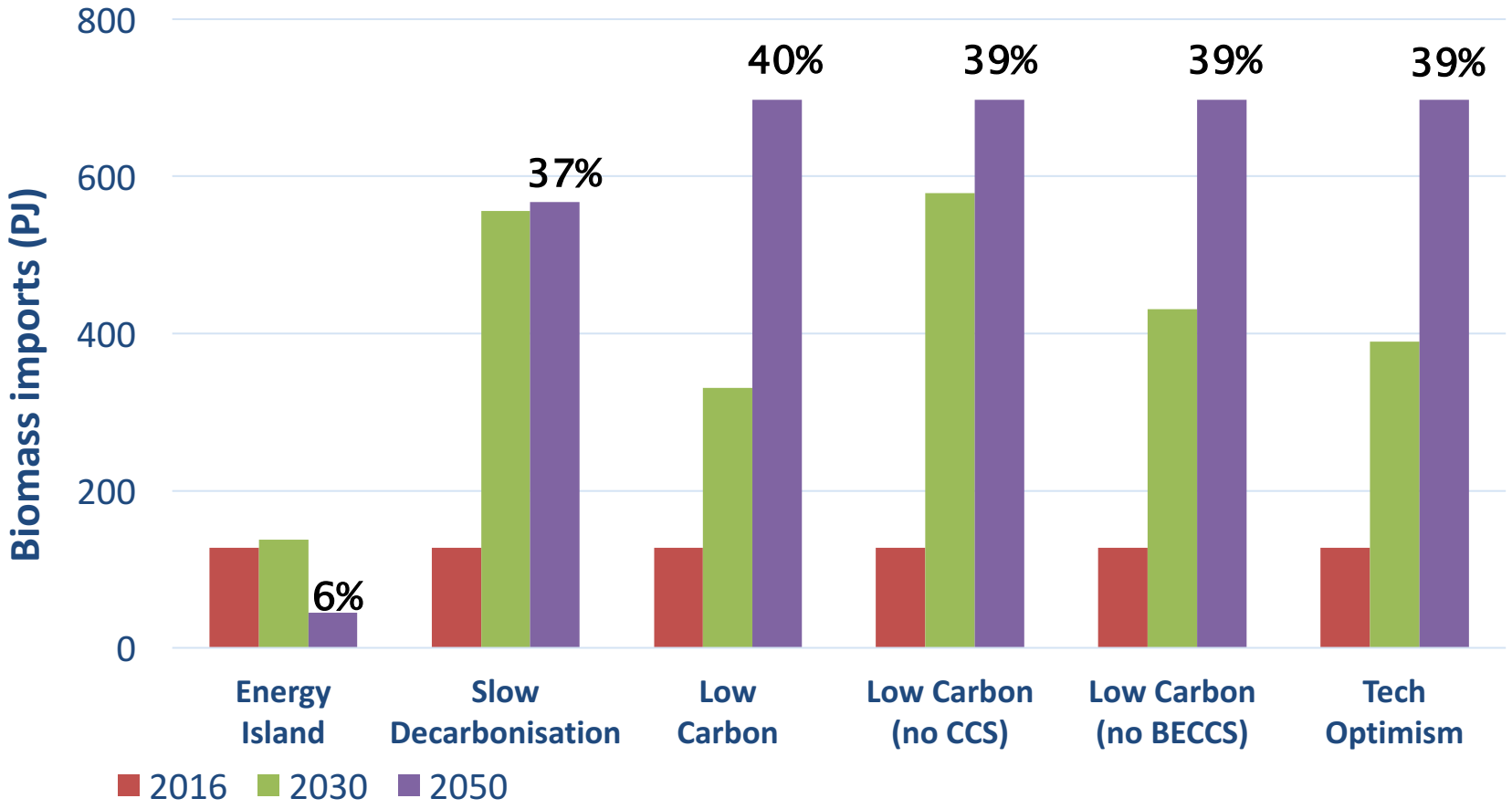
Availability indicators

Bioenergy imports / demand



Imports in 2050 as % of consumption (2016: 61%)

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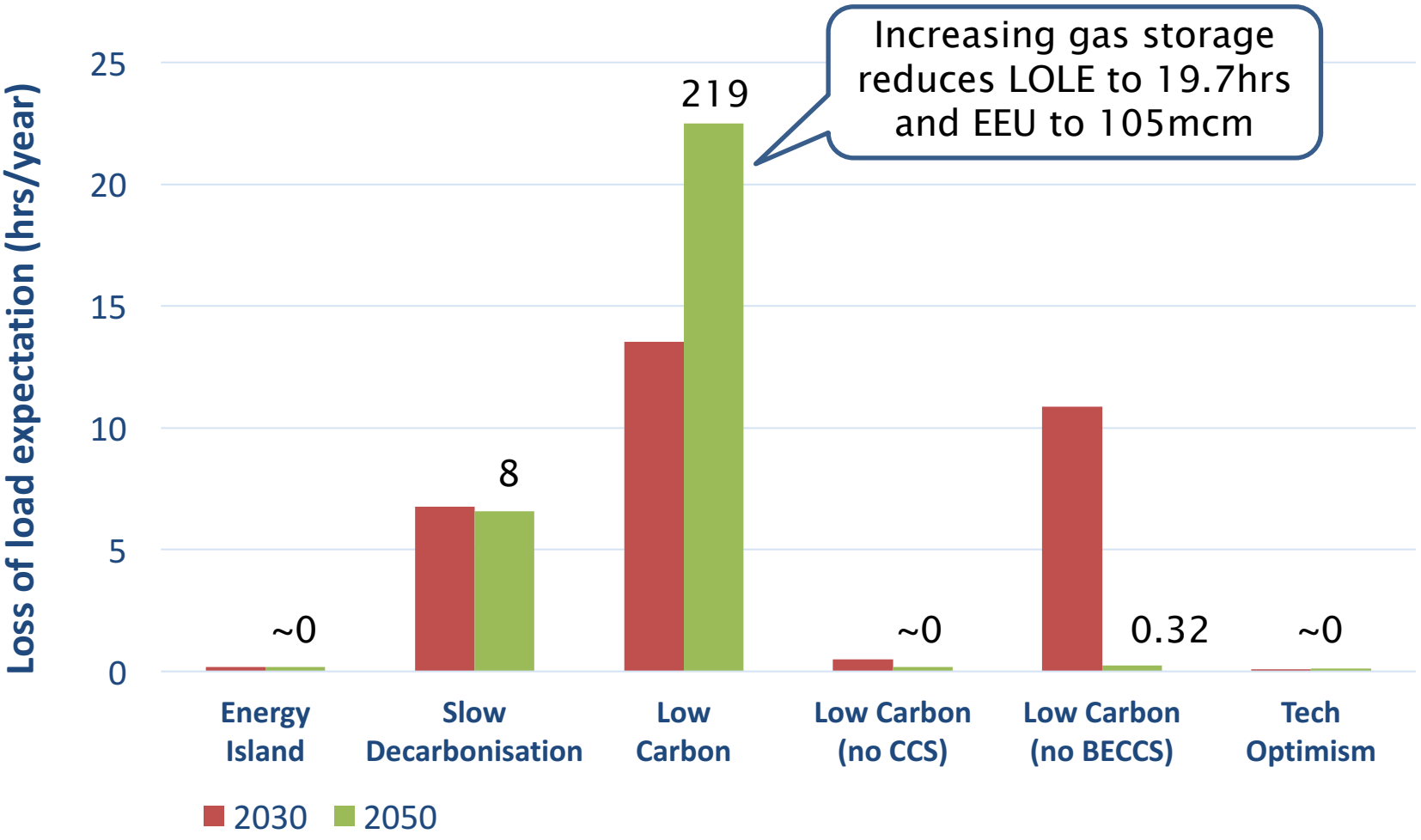
Reliability indicators
Gas: loss of load expectation



Expected energy unserved in 2050 (mcm)
(Peak daily demand in 2010: 470mcm)

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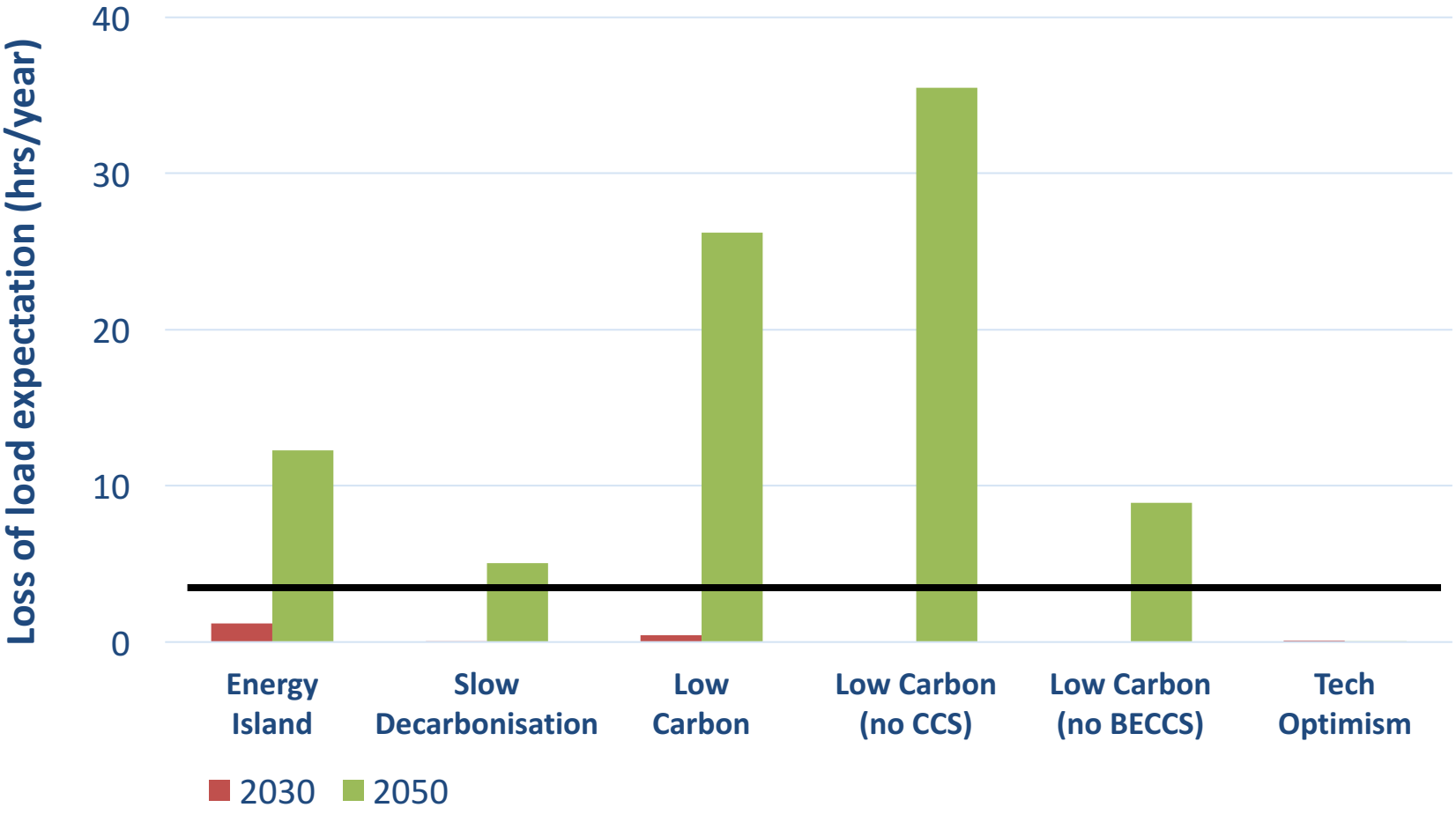
Reliability indicators

Electricity: loss of load expectation



Security standard: 3 hours per year

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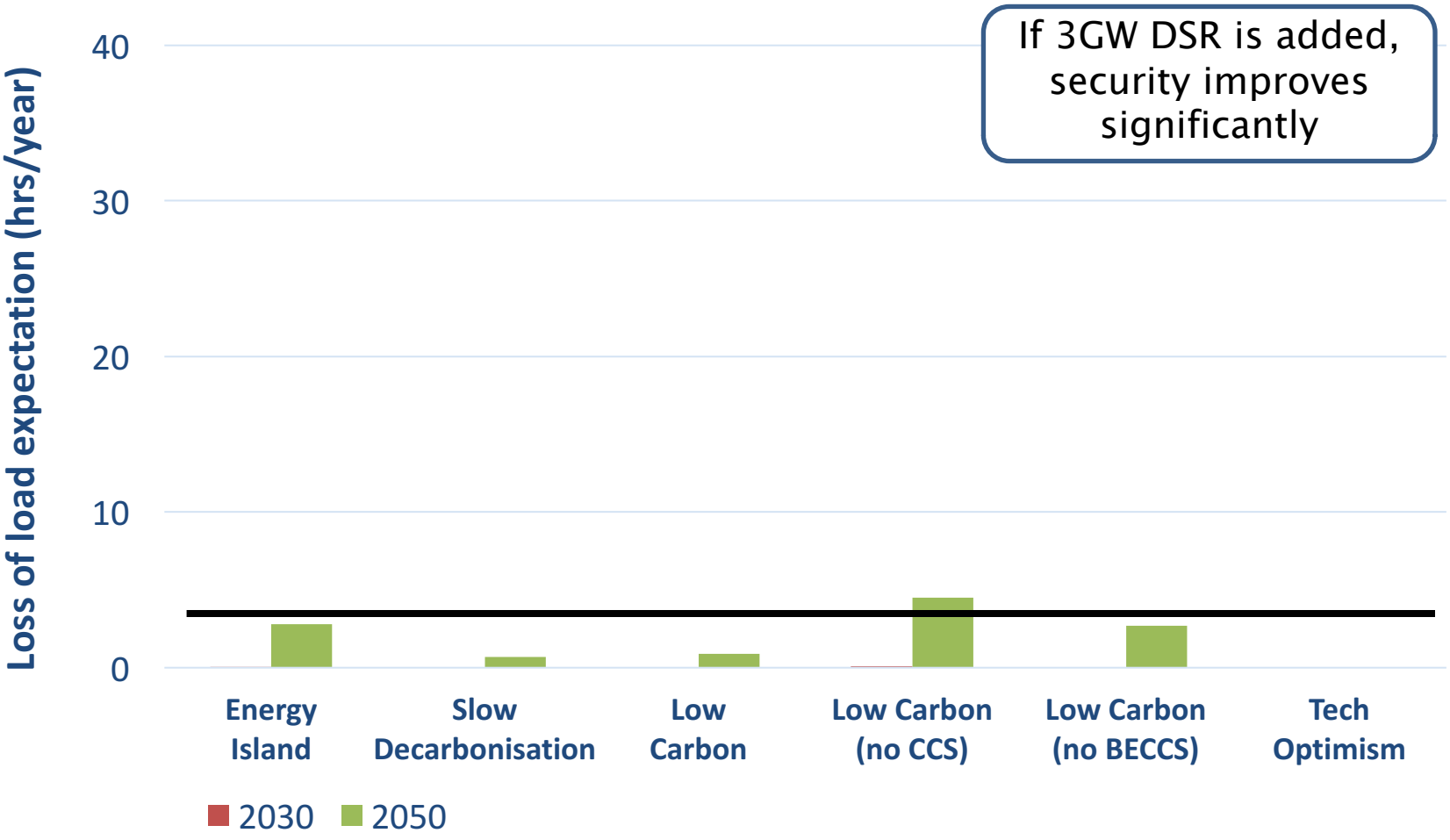
Reliability indicators

Electricity: loss of load expectation



Security standard: 3 hours per year

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Emerging conclusions

- The relationship between decarbonisation and security is not straightforward
- Energy Island & Tech Optimism have fewer ‘red lights’:
  - Tech Optimism also meets carbon targets and energy demand in 2050 is 25% lower
- Slow decarbonisation and low carbon scenarios could have higher risks?

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Emerging conclusions

- Energy imports can be a misleading indicator: share of demand plus diversity of sources / routes matter too
- Energy diversity increases as non-fossil energy grows, but could fall again in longer term
- Gas and electricity system reliability could get worse in some low carbon scenarios
  - But measures such as DSR and storage can be used to improve reliability
- Some important risks have not been assessed and are hard to quantify: especially cyber security

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Thanks

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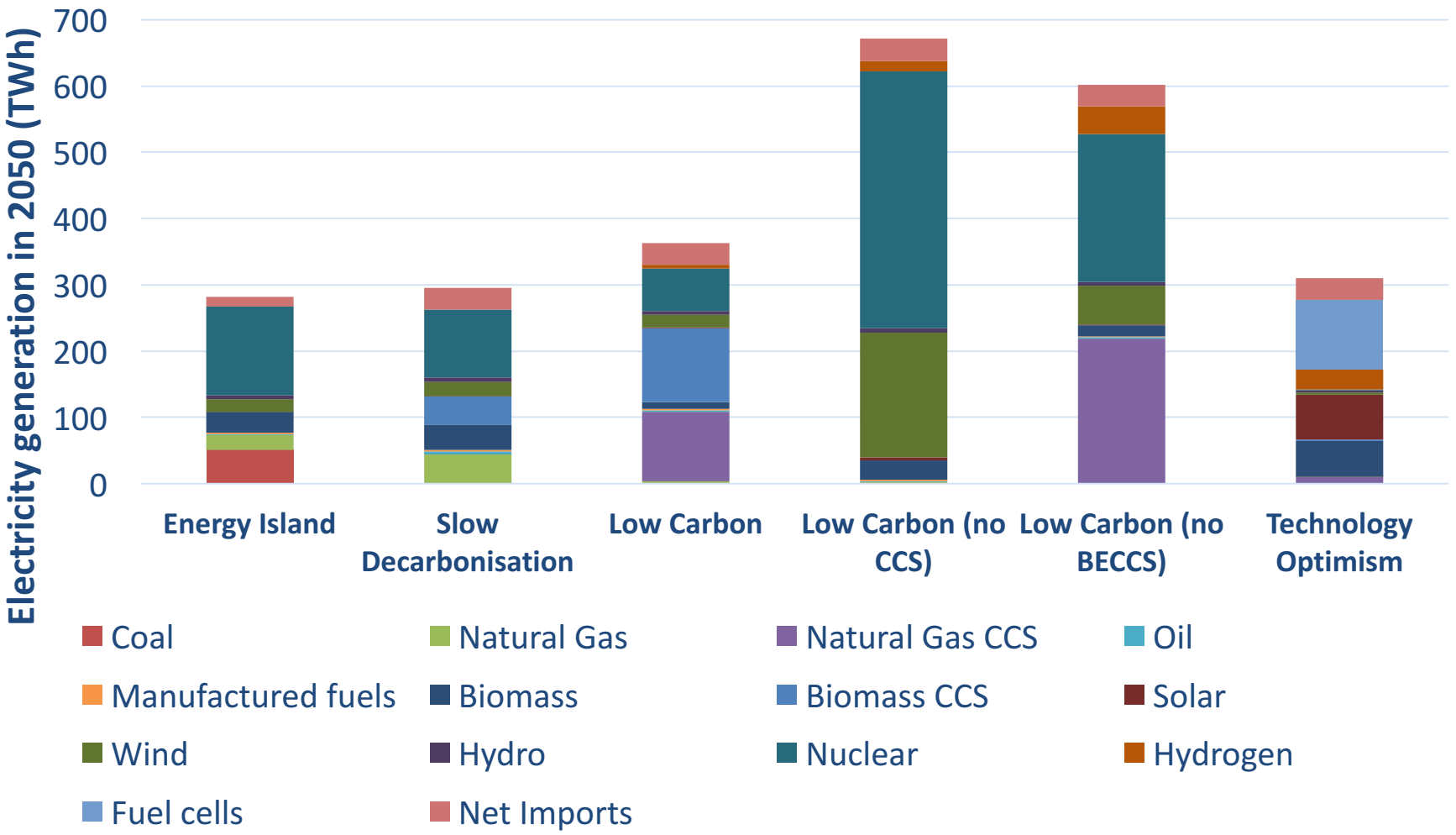
Extra slides

2017 UKERC energy scenarios

Electricity generation in 2050



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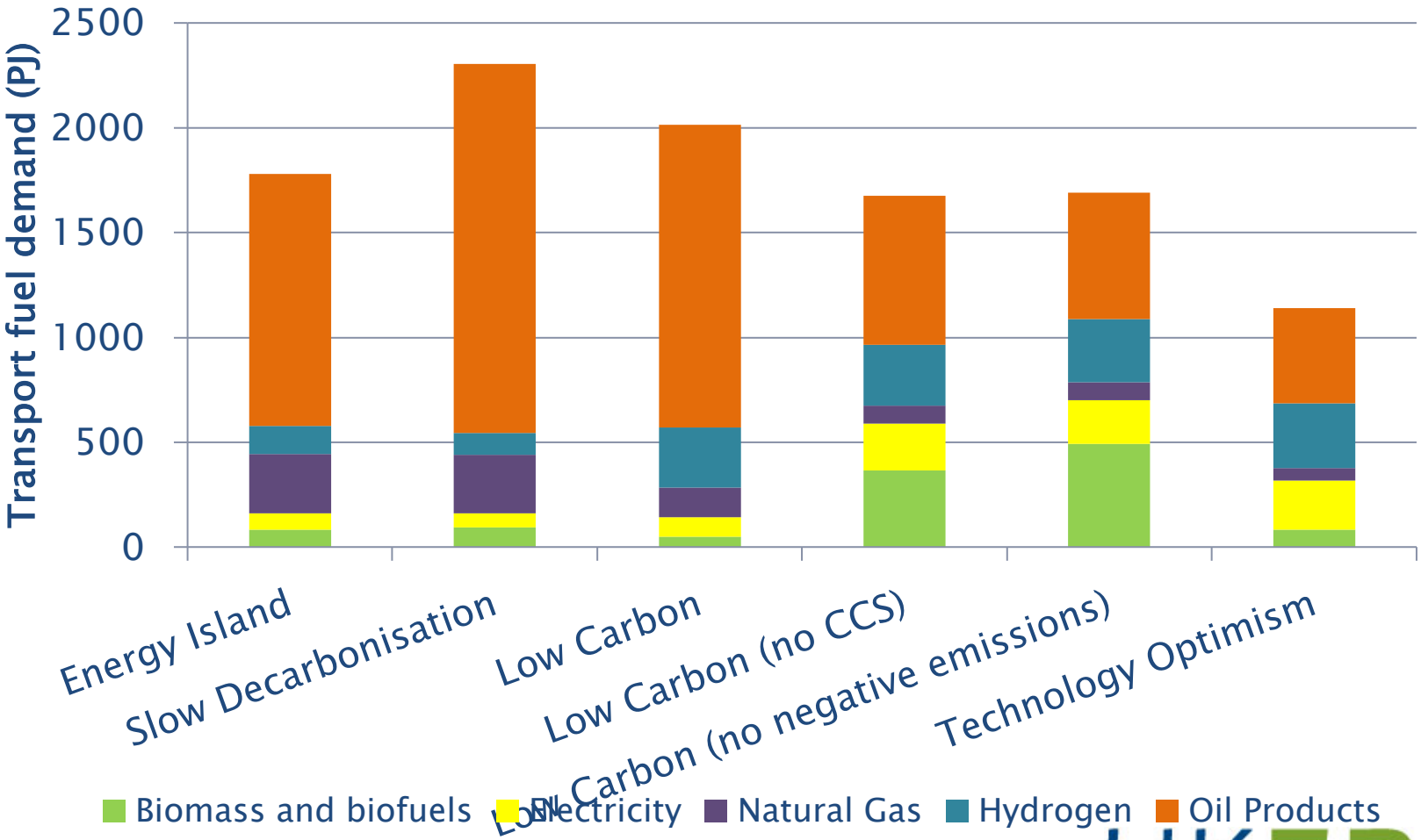
2017 UKERC energy scenarios
Transport fuel demand in 2050



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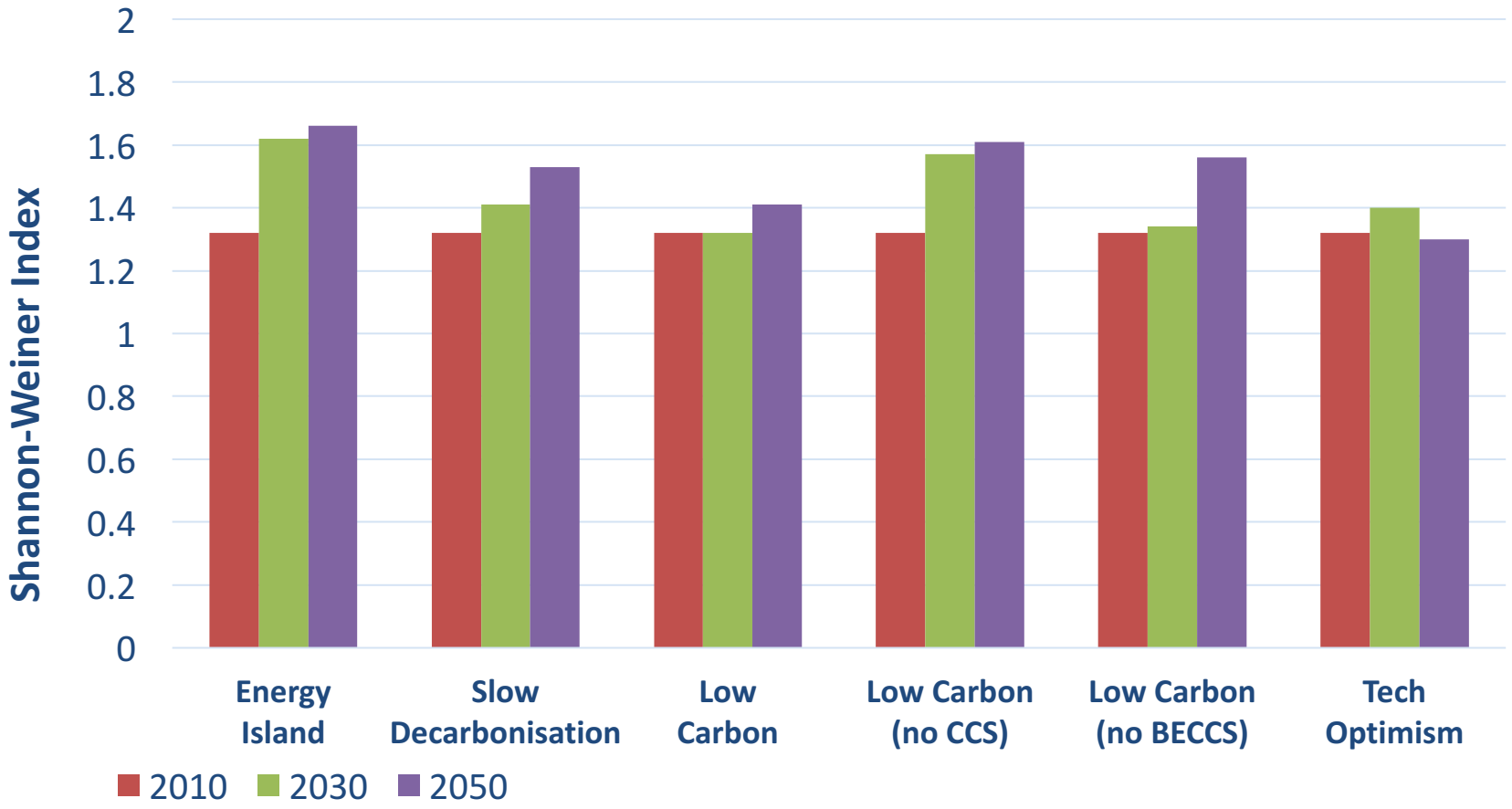
Availability indicators

Primary energy diversity



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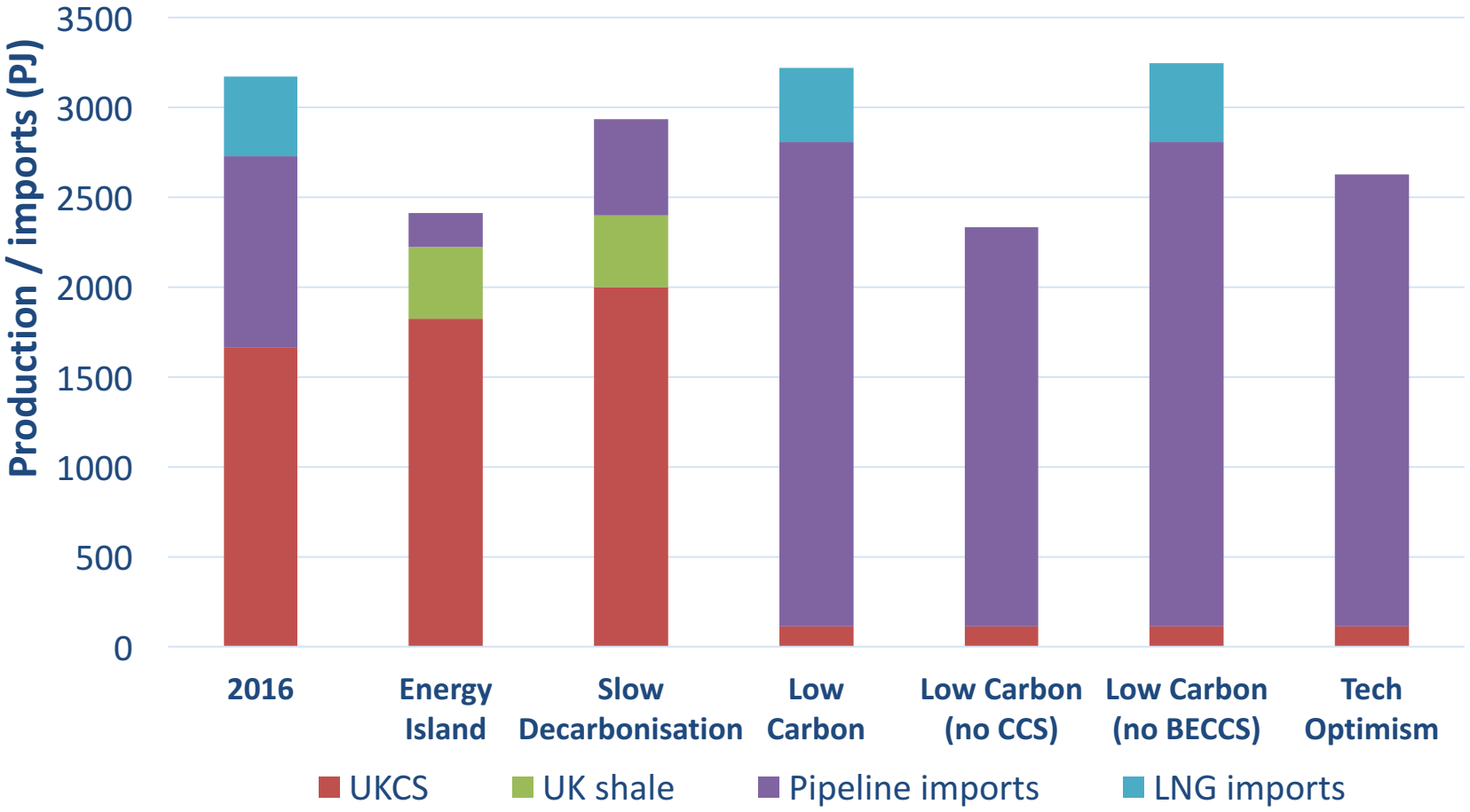
Availability indicators

Gas production and imports (2030)



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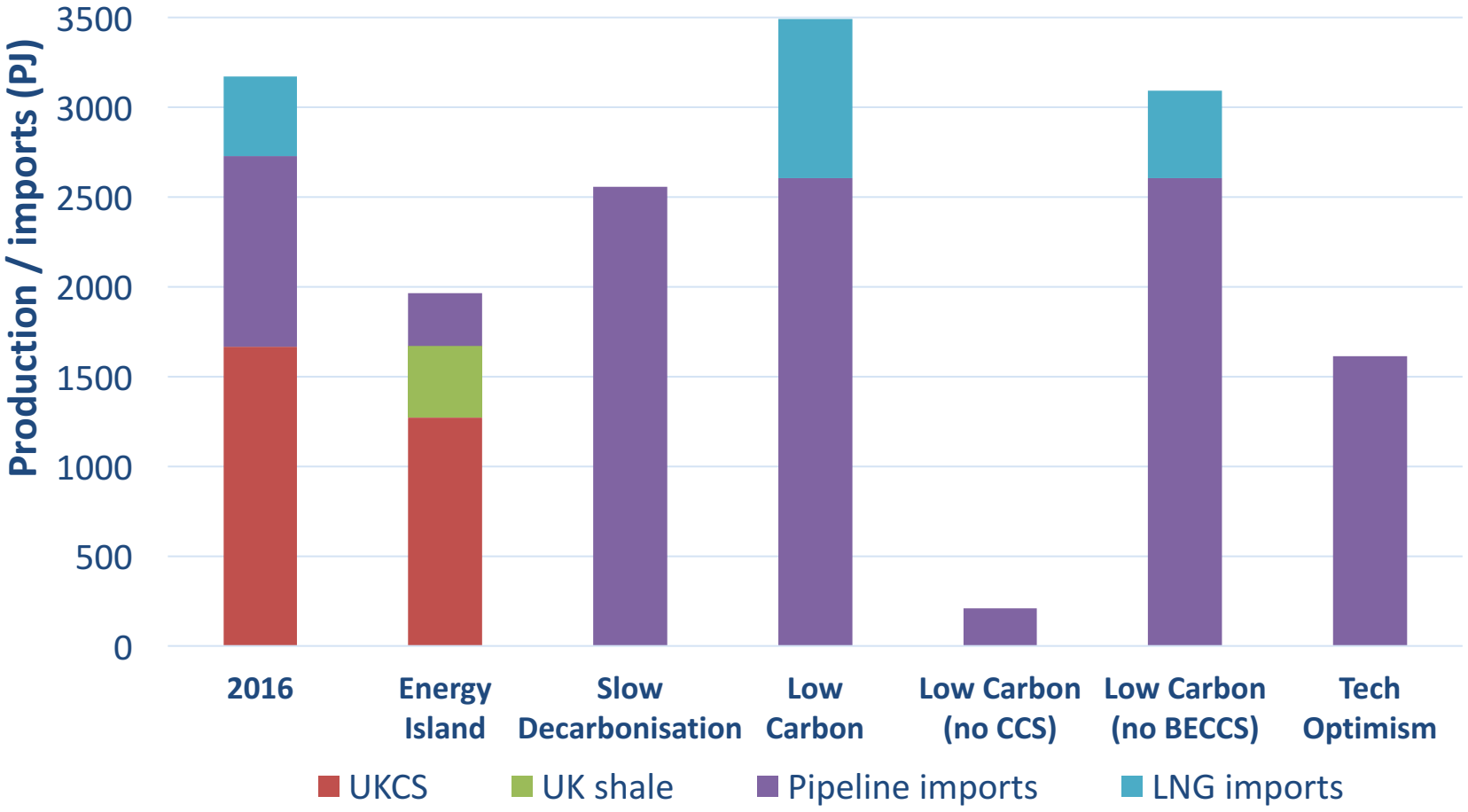
Availability indicators

Gas production and imports (2050)



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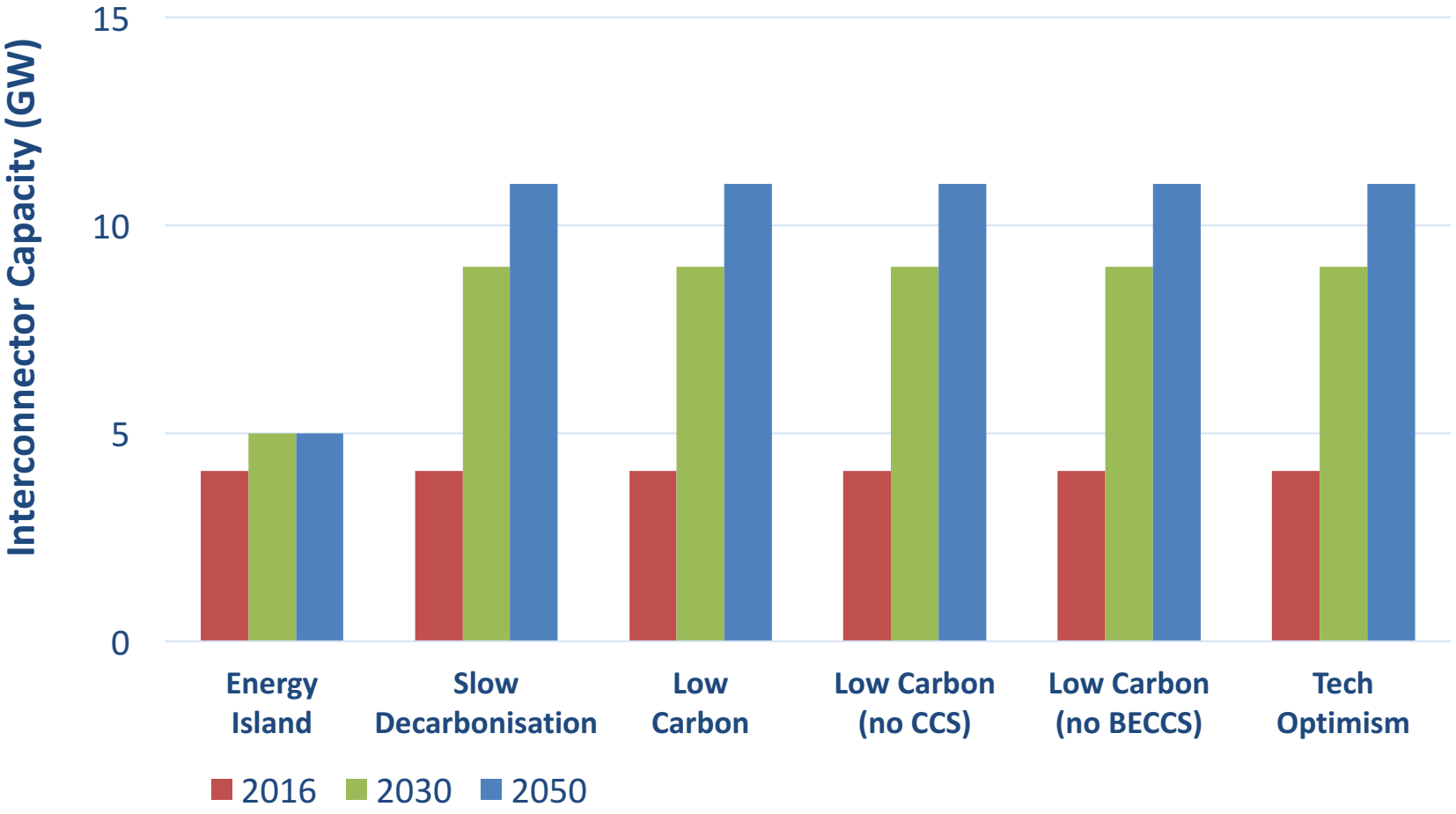
Reliability indicators
Electricity: Interconnection



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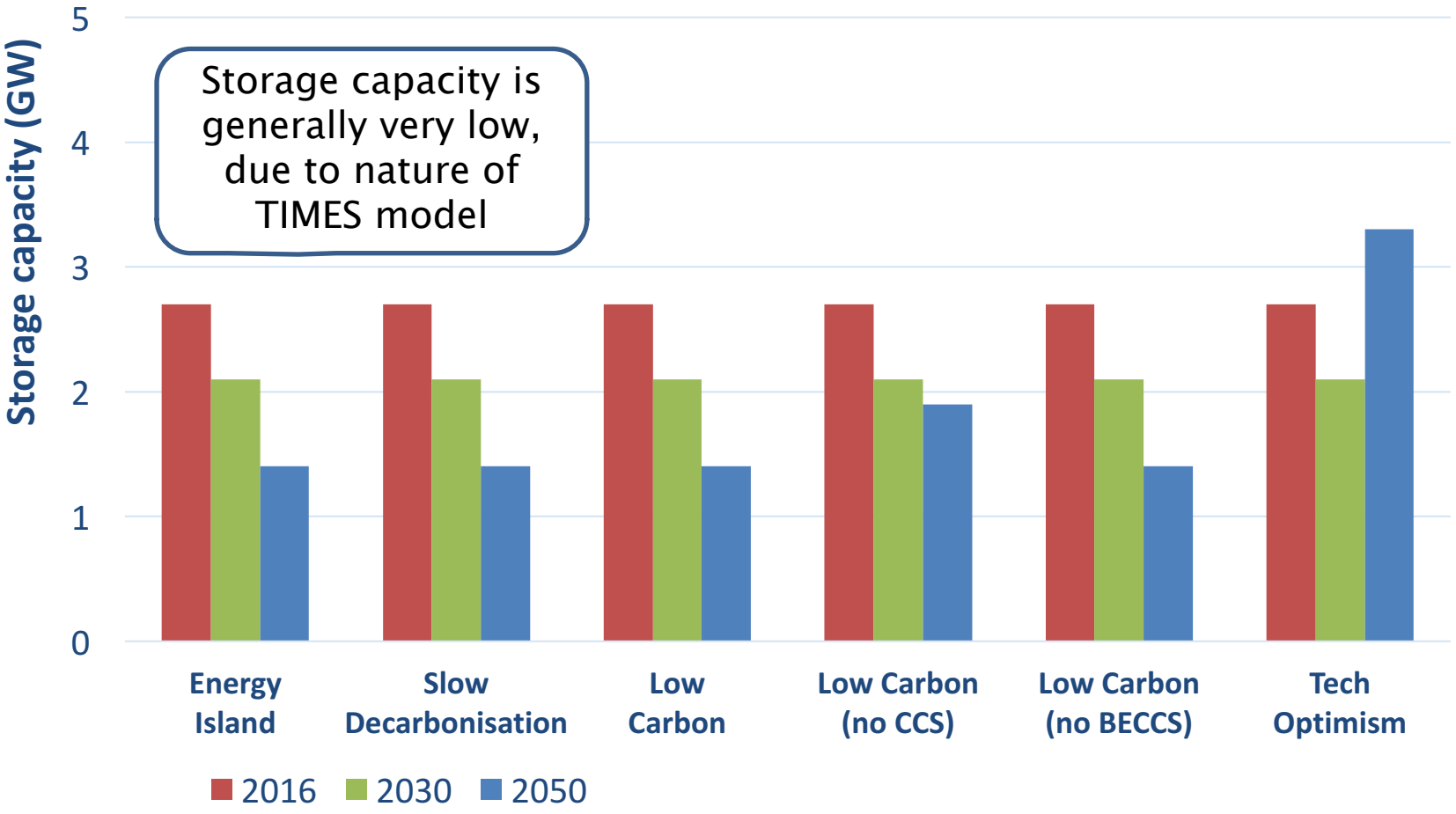
Reliability indicators
Electricity: Storage



NB: 2016 figure is for pumped storage only

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