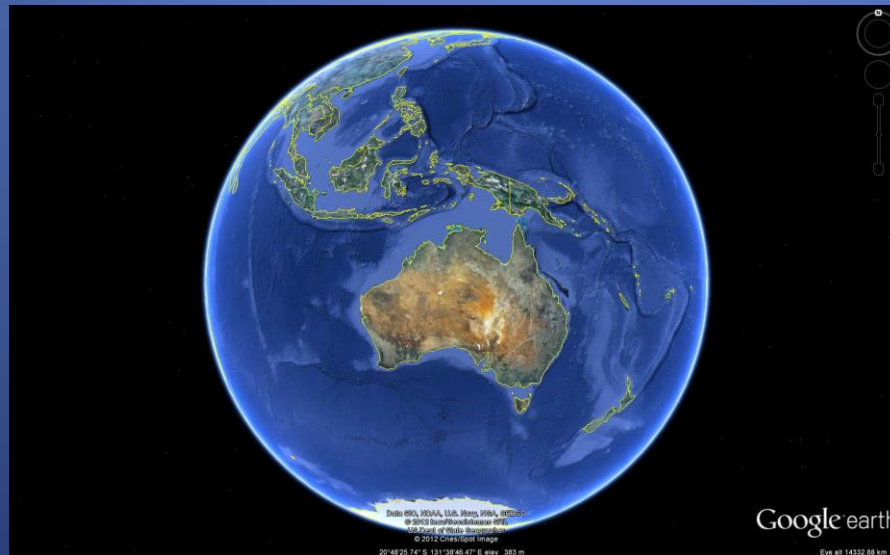


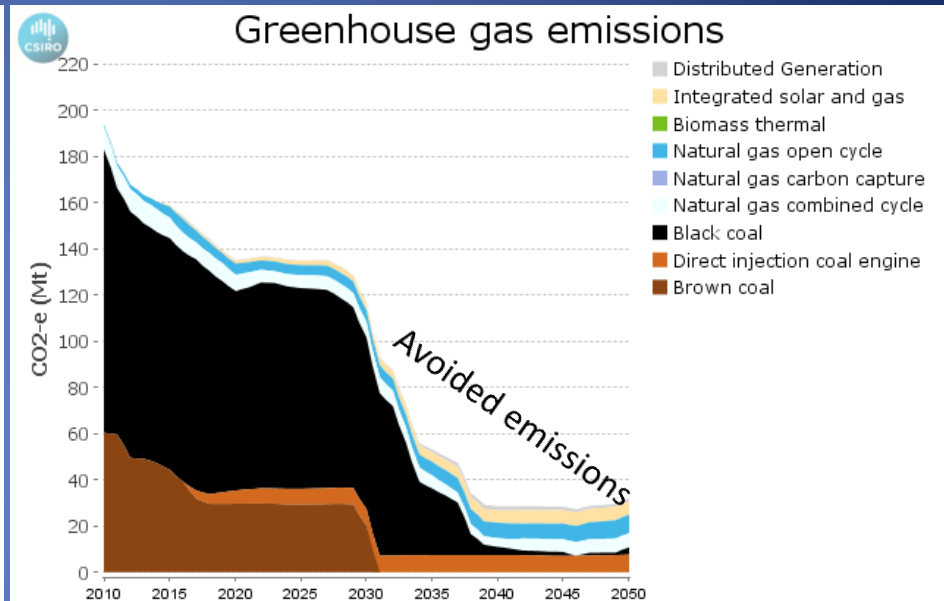
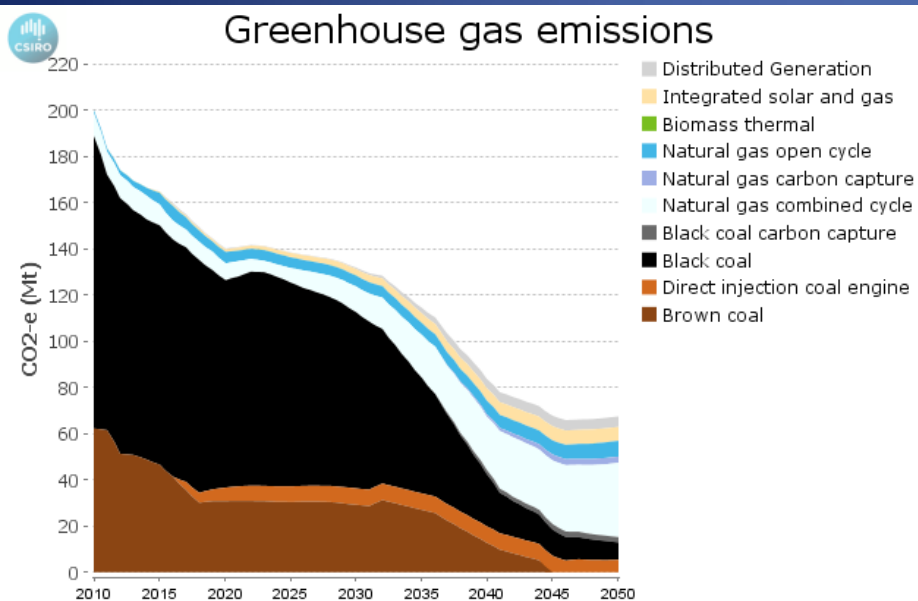


ZERO

CARBON OPTIONS



The pathway matters as much as the destination



Nuclear mimics fossil – but without the GHG
But nuclear power is prohibited in Australia

Nuclear permitted

Select option

Select option

No

Yes

Selecting “No” delivers an inferior result

Would this be clear in a comparative energy case study?

Zero Carbon Options: The Task



- Replace
Playford
– 740 M
– Respo
– 4,650
(wanted)

n and

enever it is

Option 1: Reference Renewable Solution – Solar and Wind Hybrid

Energy Source	Technology	Generation Rating	Assumed Annual Generation
Solar	Concentrating Solar Thermal (CST) power towers with heliostat mirror fields and molten salt energy storage	Six modules 760 MW total	2,810 GWh total
Wind	Enercon E-126 turbines	95 turbines at 7.5 MW each for 712.5 MW	1,840 GWh total



Source: BZE 2012

Option 2: Reference Nuclear Solution

Energy Source	Technology	Generation Rating
Nuclear	1 x Enhanced CANDU 6 (EC6) pressurised heavy water reactor	1 module at 690 MWe net

Source: ThinkClimate Consulting and Bown and Pang 2012



Two CANDU 6 reactors at
Qinshan, China

The Criteria

Financial/ Economic

- Capital cost
- Levelised cost of electricity (LCOE)
- Requirement for transmission network upgrade
- Lifespan
- Capacity factor
- Reliability



Environmental

- Greenhouse gas emissions abatement
- Water consumption
- Land area
- Major construction material requirements
- Operational waste



Social

- Job creation

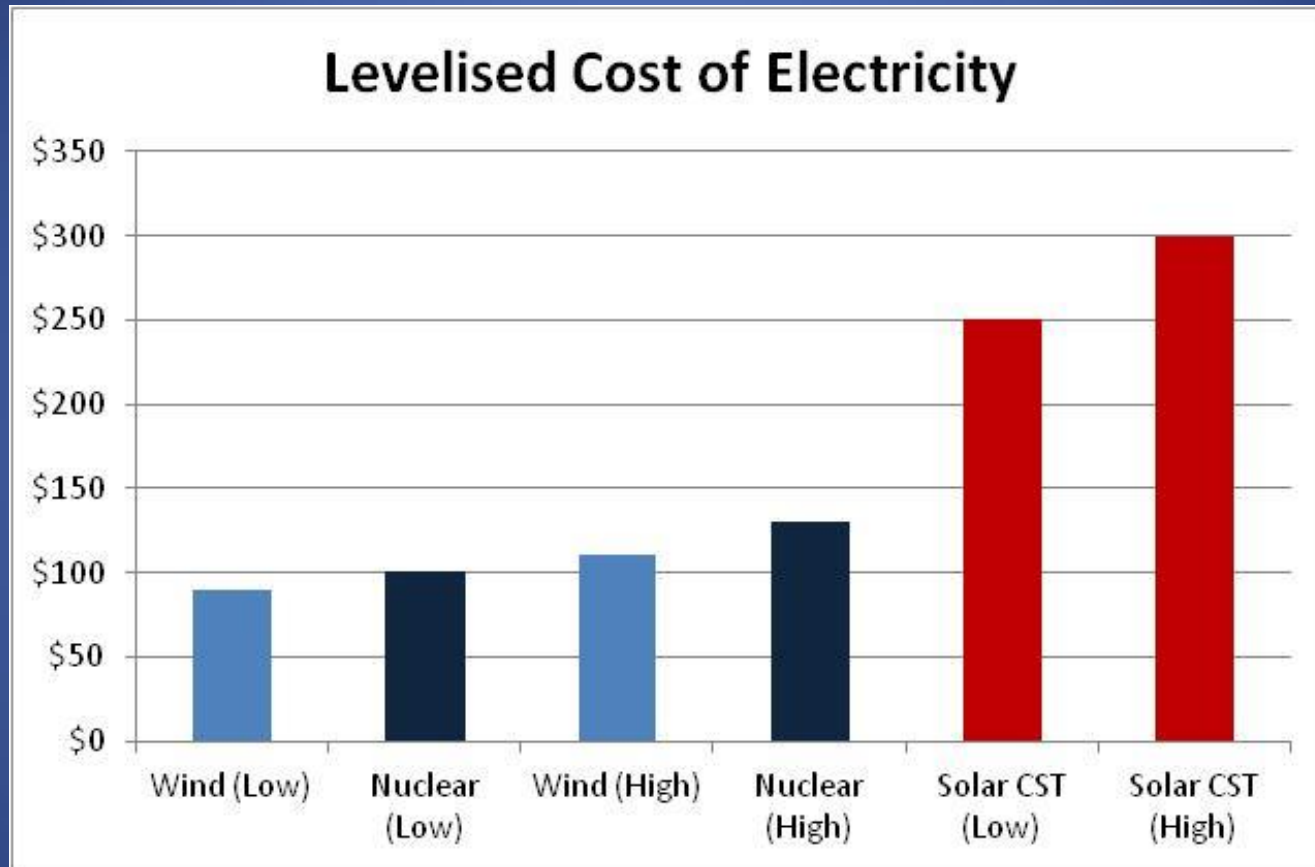


Capital Cost

- No capital cost provided in reference renewable solution
 - “Requirement for \$5 billion in public funding for 25% balance of financing” for the solar component (BZE 2012)
 - Low range estimate of \$2,000 per kW installed for onshore wind in South Australia
- Nuclear: three sources for potential costs up to 2030
 - Highly inclusive cost
 - \$5,000 - \$7,000 per kW net generation capacity

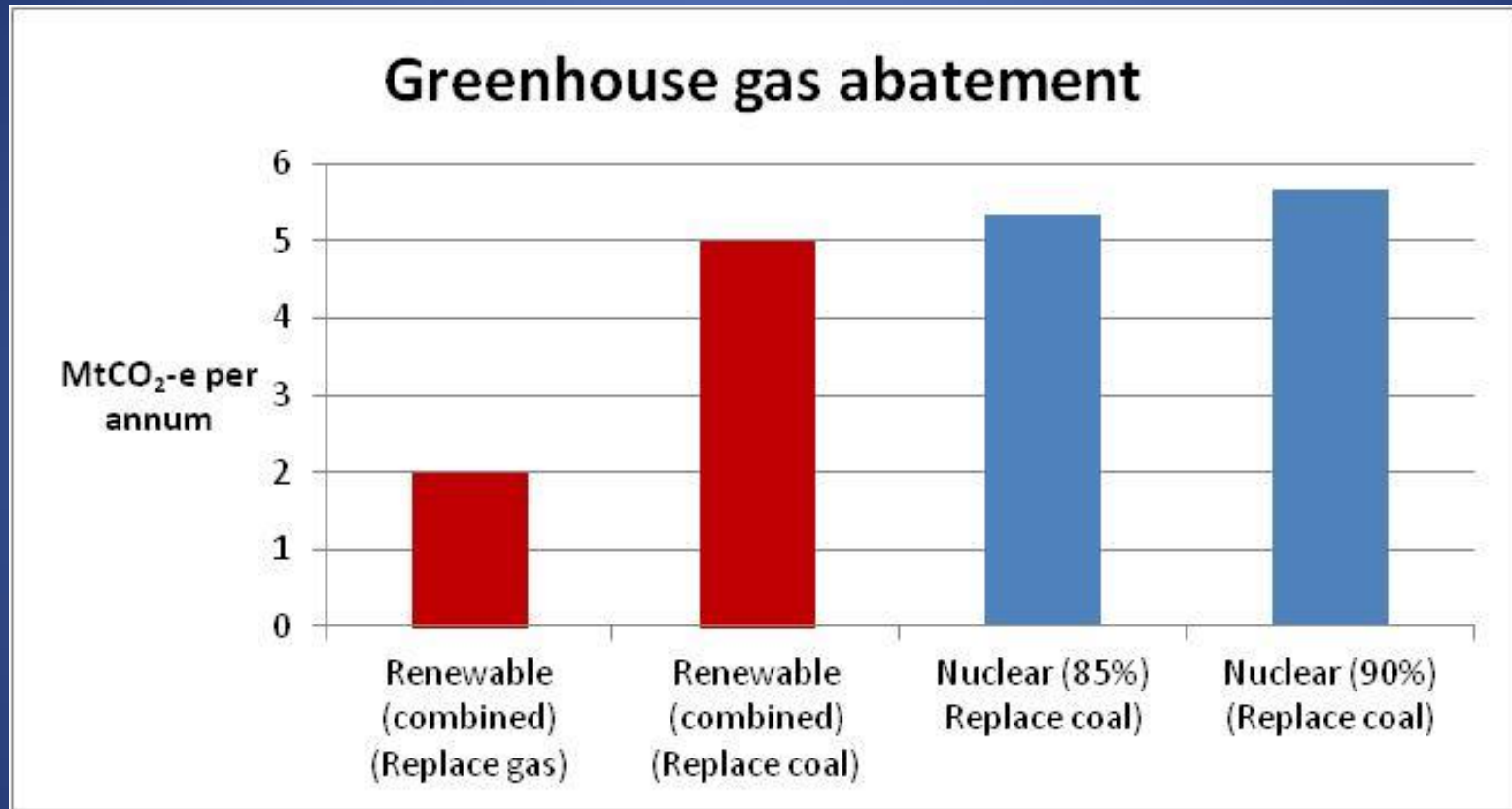
Criteria	Renewable Solar CST	Renewable Wind	Renewable: Combined	Nuclear EC6
Capital Cost	\$6.7 billion	\$1.4 billion	\$8.1 billion	\$3.5 billion - \$4.8 billion

Levelised cost of electricity



Criteria	Renewable Solar CST	Renewable Wind	Renewable: Combined	Nuclear EC6
LCOE	\$250-\$300/MWh	\$90-\$110 MWh	-	\$101-\$138

Greenhouse gas emissions abatement



Criteria	Renewable Solar CST	Renewable Wind	Renewable: Combined	Nuclear EC6
GHG Abatement	-	-	2 million – 5 million tCO ₂ -e/year	5.36 million tCO ₂ -e/year

Lifespan

CST: Low global experience

Collection and storage components may differ to generation components

Wind: Significant global experience and confident ratings

Nuclear: Significant global experience. Specific rating for EC6



Criteria	Renewable Solar CST	Renewable Wind	Renewable: Combined	Nuclear EC6
Lifespan	Assumed 25 years	25 years	-	Rated 60 years

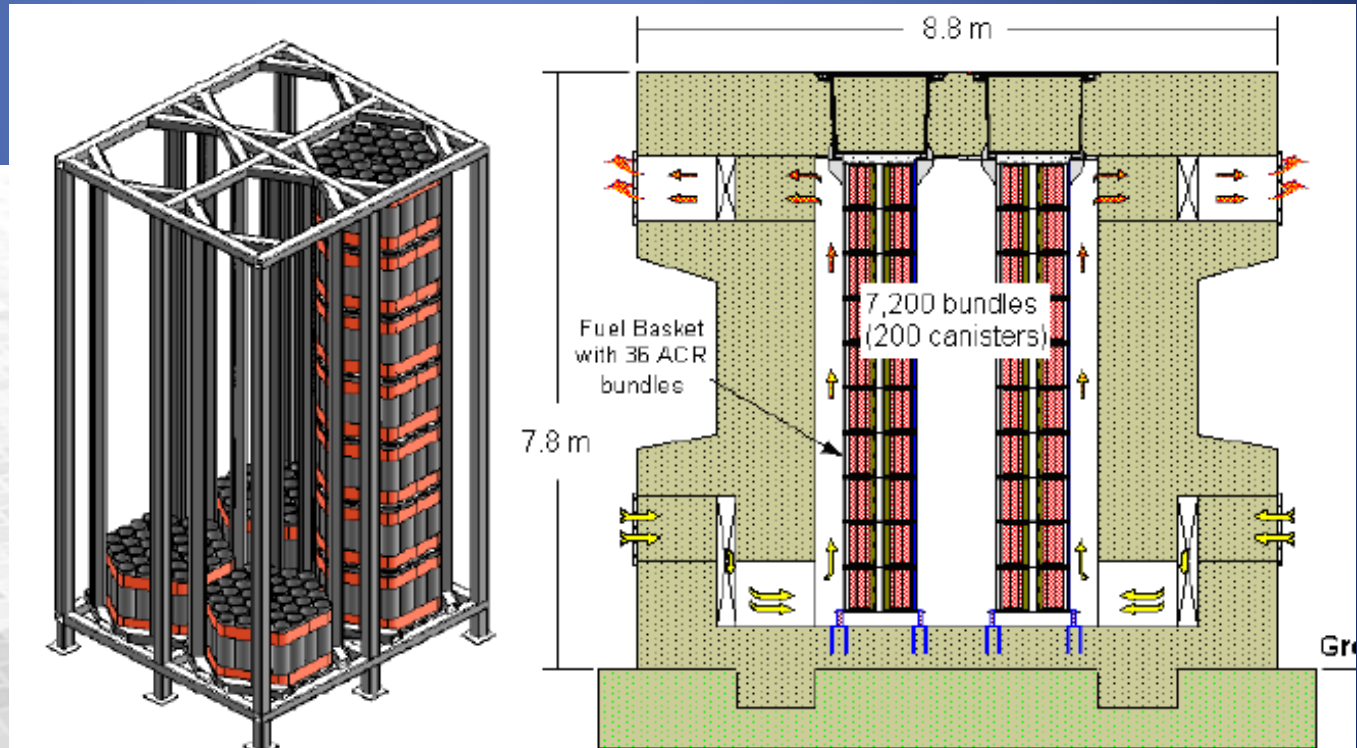
Operational Waste

Essentially zero for reference renewable solution

Reference nuclear solution generates spent nuclear fuel

Single EC6 generates 104 t spent fuel per year

Stored on-site in MACSTOR



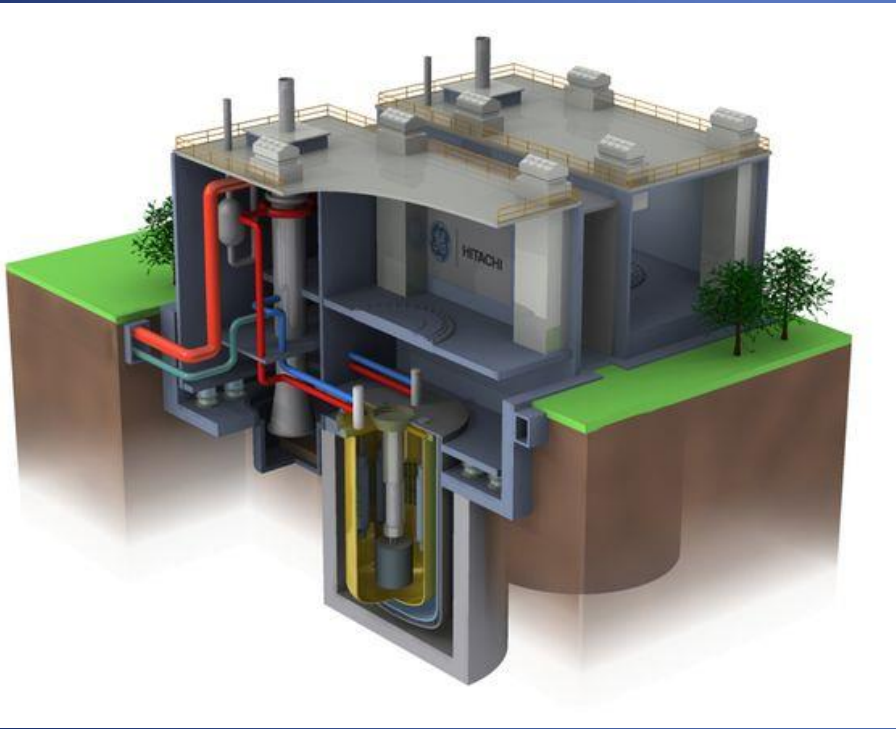
Operational Waste



Criteria	Renewable Solar CST	Renewable Wind	Renewable: Combined	Nuclear EC6
Operational Waste	-	-	-	6,250 t spent fuel, MACSTOR over 9,500 m ²

Future Fuel in Fast Reactor

GEH S-PRISM 311 MWe IFR module

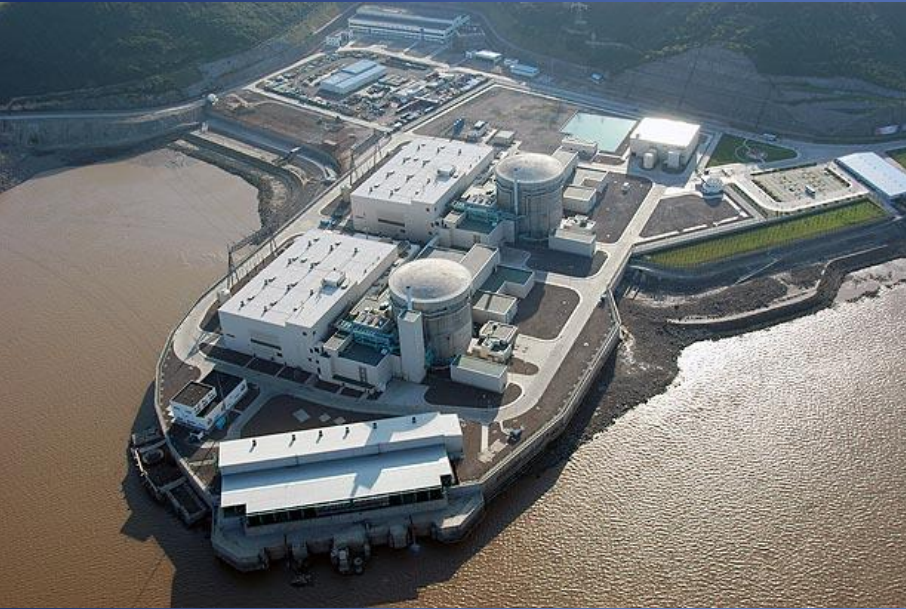


“Study finds waste-fuelled reactor feasible for UK

The report includes a vote of confidence by analysts DBD Ltd, which says that in terms of fuel fabrication, reactor operation, and fuel storage, there are "no fundamental impediments" to licensability in the UK.

July 2012

Land Use



1,360 MWe Nuclear, Qinshan China



350 MWe solar, USA (SEGS)

Criteria	Renewable Solar CST	Renewable Wind	Renewable: Combined	Nuclear EC6
Land area	16 km ² exclusive	2.1 km ² exclusive, 175 km ² non-exclusive	18.1 km ² exclusive, 191 km ² non-exclusive	2 km ² exclusive

Water Consumption



No water



Clean water for mirror washing

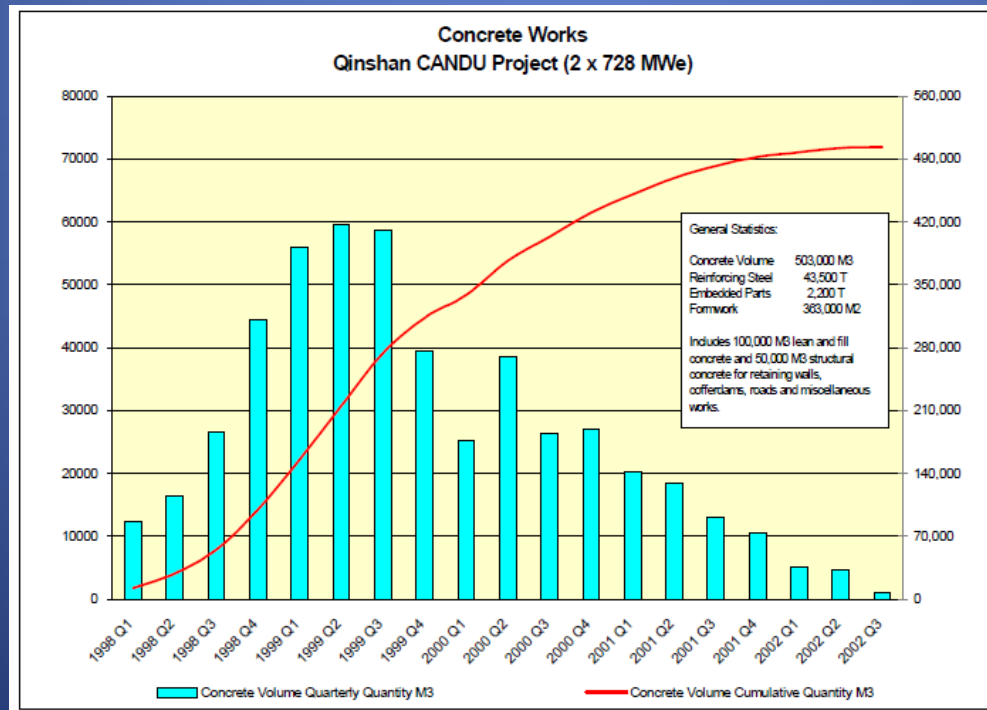


Ocean water for cooling

Criteria	Renewable Solar CST	Renewable Wind	Renewable: Combined	Nuclear EC6
Water use	0.74 GL fresh	-	0.74 GL fresh	-

Material Inputs

Technology	Comment	Confidence
CST	Heliostats only, no towers	Fair. Certain underestimate
Wind	Good general literature, not specific to Enercon turbine	Good
Nuclear	Detailed, extensive estimates for CANDU6	Excellent



Material Inputs

Criteria	Renewable Solar CST	Renewable Wind	Renewable: Combined	Nuclear EC6
Material Inputs	295,000 t steel 90,000 t glass 290,000 t concrete	80,000 t steel 300,000 t concrete	375,000 t steel 85,000 t glass 590,000 t concrete	600,000 t concrete 35,000 t steel
Lifespan	Assumed 25 years	25 years		Rated 60 years
Annual output	2,810 GWh	1,840 GWh	4,650 GWh	Up to 5,400 GWh per year
Lifetime output	70,250 GWh	46,000 GWh	<u>116,250 GWh</u>	<u>Up to 324,000 GWh</u>



Vogtle Unit 4 nuclear island with retaining wall under construction; Vogtle Unit 3 containment vessel bottom head (being assembled and welded) and module assembly building in background - November 3, 2011 ©2011 Southern Company, Inc. All rights reserved.

*For a significant materials saving, the nuclear reference solution delivers nearly **three times the lifetime output of zero -carbon electricity***

AP1000 construction USA

Capacity Factors

Ratio of maximum potential rated output and actual electricity output e.g.

CF speaks to overall variability and intermittency of output, but DOES NOT mean “it only runs 33% of the time”

Criteria	Renewable Solar CST	Renewable Wind	Renewable: Combined	Nuclear EC6
Capacity Factor	40%	30%	-	Assumed 85%, rated to 90%

Reliability



+



≠



=



- CO₂-e

Criteria	Renewable Solar CST	Renewable Wind	Renewable: Combined	Nuclear EC6
Reliability			Diminished compared to fossil	Un-diminished compared to fossil

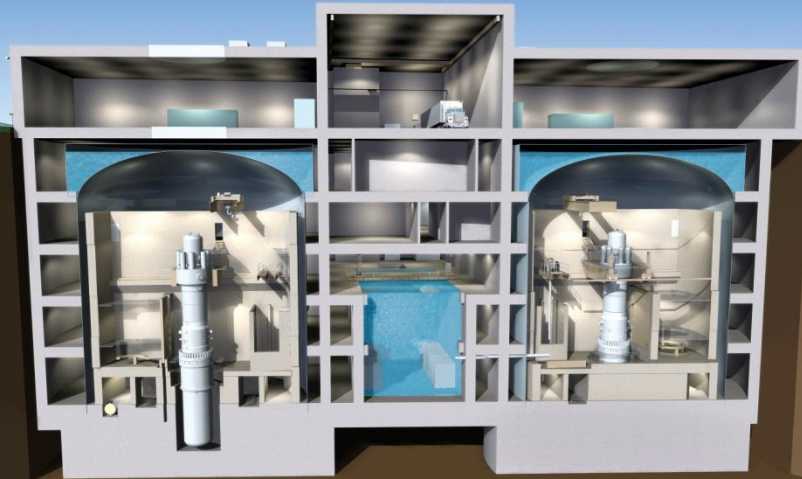
Job Creation

Both solutions provide a good job-creation outcome



Criteria	Renewable Solar CST	Renewable Wind	Renewable: Combined	Nuclear EC6
Job creation	360 direct permanent operations and maintenance jobs; Approximately 1,300 construction jobs	-	-	1,600 construction jobs and up to 520 ongoing operational onsite, offsite and contractor employment opportunities

Network Enhancement

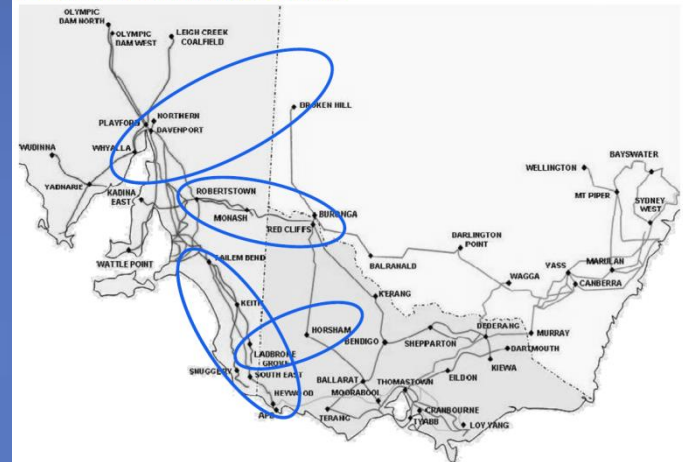


© 2011 Babcock & Wilcox Nuclear Energy, Inc. All rights reserved.



© 2012 Babcock & Wilcox Nuclear Energy, Inc. All rights reserved.

Potential transmission upgrade options



Source: WorleyParsons

Criteria	Renewable Solar CST	Renewable Wind	Renewable: Combined	Nuclear EC6
Network enhancement		-	Minimal enhancement for project connection, enhancement for larger renewable pathway	Minimal enhancement for local connection. Connection barrier based on size of single generating unit

Existing global and local capacity

Nuclear:

Nationally significant

Globally manageable, technologically unremarkable

Solar CST:

Largest single facility in the world (by far)

76 times bigger than largest Australian solar

Wind:

58% increase in wind capacity in South Australia

Operable Reactors	GWe	Reactors under construction	GWe	On order or planned	GWe
433	372	65	65	158	175

Source: World Nuclear Association 2012



World's largest solar, 350 MW (no storage)

We have options

This option could mean:

- **10% more** greenhouse gas abatement per year...



We have options

This option could mean:

- For about **half** the capital cost...



We have options

This option could mean:

- Providing significantly **cheaper** electricity...



We have options

This option could mean:

- That is completely **reliable**...



We have options

This option could mean:

- Consuming far **less land** area...



We have options

This option could mean:

- And no fresh water...



We have options

This option could mean:

- Requiring **less material** resources to build...



We have options

This option could mean:

- With over **double** the lifespan...



We have options

This option could mean:

- That uses our **local fuel** source...



We have options

This option could mean:

- And provides **high-tech** jobs...



We have options

This option could mean:

- Deploying **commercially mature** technology



We have options

This option could mean:

- **10% more** greenhouse gas abatement per year...
- For about **half** the capital cost...
- Providing significantly **cheaper** electricity...
- That is completely **reliable**...
- Consuming far **less land** area...
- And **no fresh water**...
- Requiring **less material** resources to build...
- With over **double** the lifespan...
- That uses our **local fuel** source...
- And provides **high-tech** jobs...
- Deploying **commercially mature** technology

Are we ready to put this option
on the table?





ZERO

CARBON OPTIONS