

Centre for Energy and Environmental Markets	UNSERIO O NOV CONTRACTA					
Electricity Generation Portfolio Analysis for Coal, Gas and Nuclear Plant Under Future Uncertainties						
<b>Peerapat Vithayasrichareon</b> , Iain MacGill, and Fushuan Wen IASTED Asian Conference on Power and Energy Systems						
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Centre for Energy and Environmental Markets	UNSW the electricity industry							
Potential Roles	Concerns							
<ul> <li>Address energy security concerns due to fossil fuel dependence</li> <li>Nuclear is less sensitive to fuel prices volatility</li> <li>Low contribution of fuel costs</li> <li>Reduce GHG emissions</li> <li>Zero operating carbon emissions</li> <li>Low embodied carbon emissions</li> </ul>	<ul> <li>Significant uncertainty in its economic viability</li> <li>Extremely high capital costs</li> <li>Long lead times</li> <li>Significant financing charges</li> <li>Others</li> <li>Waste management</li> <li>Nuclear proliferation</li> <li>Radiation risks</li> </ul>							
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Expected Load Duration Curve Duration Curve Annualized fixed cost of each technology (S/MW) For each possible mix of generation technologies Cenerate random values of uncertain parameters from pre-defined probability distribution Calculate variable cost of each technology (S/MWh)	<ul> <li>Ization model</li> <li>Generation cost (\$/year) = Fixed Cost (FC) + Variable Cost (VC)</li> <li>FC = annualised fixed cost (\$/yr)</li> <li>incur regardless of energy produced</li> <li>VC = O&amp;M cost + Fuel cost + Carbon cost (\$/year)</li> <li>Amount of energy generated by each technology is determined from</li> </ul>
Calculate Calculate Overall generation cost (S/MWh) and CO <sub>2</sub> emissions of each generation Run (n samples) VES Expected generation cost, risk and CO <sub>2</sub> emissions of	<ul> <li>economic dispatch</li> <li>Results consist of</li> <li>Expected generation cost (\$)</li> <li>SD of cost, which represents the 'cost uncertainty' (risk).</li> <li>Expected CO₂ emissions of each generation portfolio (tCO₂/yr)</li> </ul>

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C	Case study Generation portfolios consist of Coal, CCGT and Nuclear Eaces uncertain future fuel prices, carbon price and plant capital costs									
	<ul> <li>Praces uncertain future fuer prices, carbon price and plan capital costs</li> <li>Share of each technology ranges from 0-100% of total capacity in 20% increments: 21 generation portfolios</li> </ul>									
No.	%Sha coal 0	CCGT	Nuclear	No. 12	%Sha coal 0	re of teo CCGT 0	Nuclear 100		For each portfolio – the calculation of cost is	
2 3 4	0 0 0	20 40 60	80 60 40	13 14 15	0 0 0	20 40 60	80 60 40		simulated single years of	
5 6 7 8	0 0 20 20	80 100 0 20	0 80 60	16 17 18 19	0 0 20 20	80 100 0 20	20 0 80 60		fuel and carbon prices and plant capital costs	
9 10 11	20 20 20	40 60 80	40 20 0	20 21	20 20	40 60	40 20		F	
Vithay	/asricha	ireon, Ma	cGill, Wen	A					8	
"Elec	tricity G	eneration	Portfolio A	Analysi	s for Co	al, Gas a	nd Nuclear	Plant	Under Future Uncertainties"	



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Case study - Inputs											
		In	puts								
Genera	pected d profile	Stochastic model of uncertain parameters									
Technolog economic pa of each tec	Fuel prices Carbon price Plant capital costs										
Attributes**	y										
Plant life (Years) Capital cost (\$/MW)	Coal 40 1.400.000	25 650 000	Nuclear 40 4.000.000		Carbon price	Coal price	Gas Price	Nuclear fuel price			
Fixed O&M (\$/MW/yr)	Fixed O&M (\$/MW/yr) 43,000 25		100,000	Moon	(\$/tCO2)	(\$/GJ)^^	(\$/GJ)^^	(\$/GJ)			
Efficiency (%) 42 58		58	35	SD	20 10	2.00	1 935	0.05			
Variable O&M (\$/MWh)         3.3         1.5         2         30         10         0.203         1.933           EF(tCO <sub>2</sub> /MWh)         0.8         0.35         0         ** Sources: IEA, "Electricity Information 20"							0.00				
** Sources: IEA, NEA/IEA (2005), MIT(2009) Vithayasrichareon, MacGill, Wen "Electricity Generation Portfolio Analysis for Coal, Gas and Nuclear Plant Under Future Uncertainties" 9											



























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