Funded by
Foreign & Commonwealth Office, the UK

Modelling Carbon Emission Reductions in CHINA

The WADE Economic Model - 1

The WADE Economic Model calculates economic and environmental impacts of supplying new electric load growth with varying mixes of central generation (CG) and decentralised (DE) generation. As demand grows and existing plants retire, the model builds user-specified capacity over a 20 year period. The WADE Economic Model has four main outputs: Capital Costs; Retail Costs; Fossil Fuel Use; and Pollutant Emissions (CO_2, NO_x, SO_2, PM_{10}). With funding from the UK Government, the WADE Model has been applied to China.

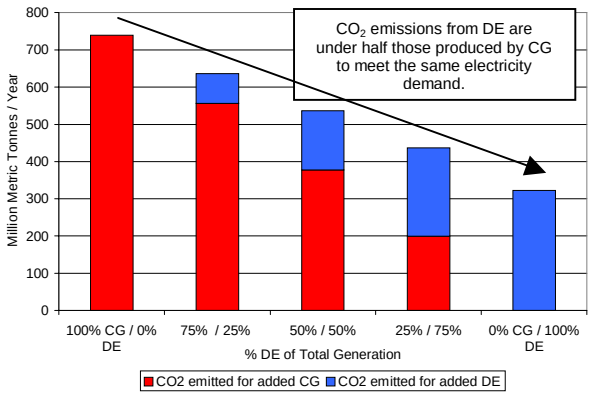
Summary of Model Outputs – China 2002-2021

DE provides a highly cost-effective solution for cutting CO_2 emissions in China

DE is less fossil fuel intensive than thermal CG and produces significantly lower carbon emissions (figure 1).

In WADE's Reference Scenario, CO_2 emissions for 100% DE[1] are 56% lower than for 100% CG. The Model shows that the use of nuclear power is not necessary to deliver cost-effective carbon emission reductions: even in the Model's High Coal Scenario, DE emits less CO_2 than CG in the Low Carbon Scenario (figure 2). Emissions of NO_X, SO_2 and PM_{10} are also significantly reduced[2].

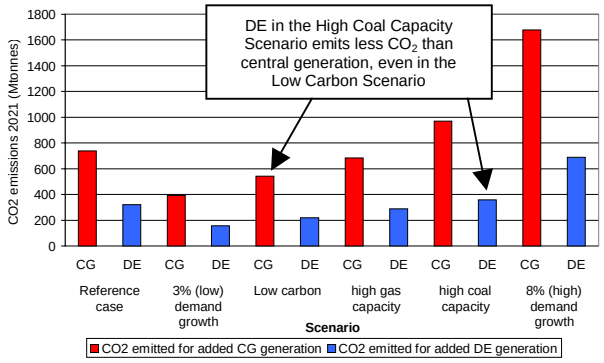
Figure 1: Annual CO_2 Emissions from New Plant for Newl 2021 Load



DE can meet demand growth at lower cost than central generation

In every scenario, DE is able to meet new demand growth requirements in China with both lower capital and retail costs than CG. The scale of the retail and capital cost benefits of DE is shown in figures 3 and 4 (over page). Compared to the 100% CG scenario, the 100% DE scenario cuts retail costs by 28% and capital costs by 38%, representing a saving of **US$400 billion** to 2021.

Figure 2: CO_2 Emissions from New Capacity in China in 2021 under Different Scenarios

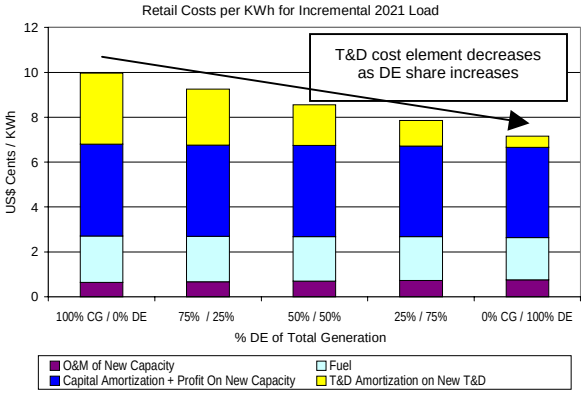


WADE, 2004

[1] The extreme cases, where 100% of new generating capacity between years 1 and 20 is allocated to one or the other (i.e. 100% new CG or DE). In reality, it is highly unlikely that either situation will arise; the most likely scenario will be a CG / DE mix between these extremes. It is also important to recognize that the 100% DE scenario implies that only incremental generating capacity in the 20 year period would be built as DE – not that *all* capacity is DE.

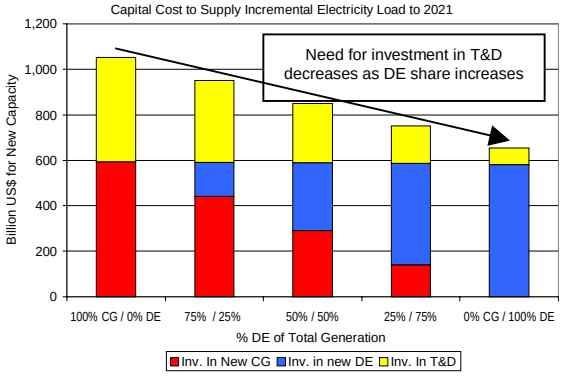
[2] The model takes account of emissions saved by CHP from displaced boiler plant.

Figure 3: Retail Costs for New Capacity in WADE's Reference Scenario



WADE, 2004

Figure 4: Capital Costs for New Capacity in WADE's Reference Scenario



Why less cost for DE? DE requires less transmission and distribution (T&D)

The T&D network has high capital, operations and maintenance costs as well as significant energy losses. Unlike CG, DE is sited close to demand, so electricity flows shorter distances to customers, greatly reducing the need for T&D investment to meet the same level of demand. WADE's modelling shows that, in addition, DE is much less affected by rises in T&D costs. Both capital and retail costs for CG are strongly affected by rises in T&D costs.

Demand growth has the largest impact on capital costs, fossil fuel use and emissions.

An annual electricity demand growth rate of 3% cuts the capital cost requirement by 49% compared to the Reference growth rate of 4.8%. This demonstrates the importance of end-use efficiency in controlling costs and environmental impacts of electricity generation.

The WADE Economic Model - 2

With changed input assumptions, the Model can be adapted to any country, city or region in the world. To date, the WADE Economic Model has been applied to: **Brazil**; **China** (funded by the Foreign and Commonwealth Office, the UK); **The European Union** (funded by the EU DG-Fer programme); **Ireland** (funded by the Republic of Ireland Government); **The Canadian Province of Ontario** (funded by the Canadian Federal Government); **Thailand** (funded by the EU COGEN-3 programme); **The USA**; and **The World**.

Full China results, an explanation of the Model and WADE's assumptions are available at www.localpower.org.

About WADE

WADE is a non-profit research and advocacy organisation established in June 2002 to accelerate the worldwide deployment of DE systems.[3] Through its network of Members, WADE now has the support of over 200 corporations around the world. WADE believes that the wider use of DE holds the key to bringing about the cost-effective modernisation and development of the world's electricity systems.

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[3] These include high efficiency cogeneration / CHP, on-site renewable energy systems and energy recycling systems, regardless of fuel, technology or project size.