The Economic Benefits of Decentralized Energy in Brasil

4th International CHP/DE Conference and Exhibition
- Rio de Janeiro, 1 October 2003 -

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Agenda

- Introduction to the Model
- Outputs of WADE economic model for Brasil
- A comparison with the economic model for the USA
- Conclusions

WADE's definition of Decentralized Energy (DE)

Electricity production *at the point of use*, irrespective of size, fuel or technology:

- High efficiency cogeneration – 1 kWe - 400 MWe+
  - Includes: Gas turbines, reciprocating engines, steam turbines, fuel cells, microturbines, Stirling engines.
- Decentralized renewable energy technologies, including photovoltaic systems, small hydro, on-site biomass and wind power.
- Recycling Energy

The WADE Economic Model

- Model first designed by WADE Chairman, Tom Casten, for the USA
- WADE have adapted it for other countries including Brasil, EU and on a worldwide basis
- Objectives:
  - Describe process of selecting optimum future generation – central generation or decentralized generation?
  - Compares capital expenditures, power costs, emissions, vulnerability for central plant and decentralized generation
  - Model calculates supply of incremental power in 2020 with nine mixtures of CG and DG

Model Inputs

User can change:

- Mix of DE and central technologies
- Cost, performance and improvement rate assumptions
- Baseline to any country or region
- Each generation technology:
  - Capital costs
  - O&M costs
  - Performance
  - Emissions

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Sources and Assumptions

- Key Data collected from:
  - Brasilian Energy Balance - 2002
  - Energy Information Administration, US Department of Energy
  - World Energy Outlook, International Energy Agency
- Key Assumptions
  - Load growth to 2020 – Brasil 2.4% pa;
  - Spare/reserve T&D – Brasil nil from 2003;
  - Line losses on average for central power – Brasil 16.5%;
  - Line losses at peak load – Brasil 21.5%;

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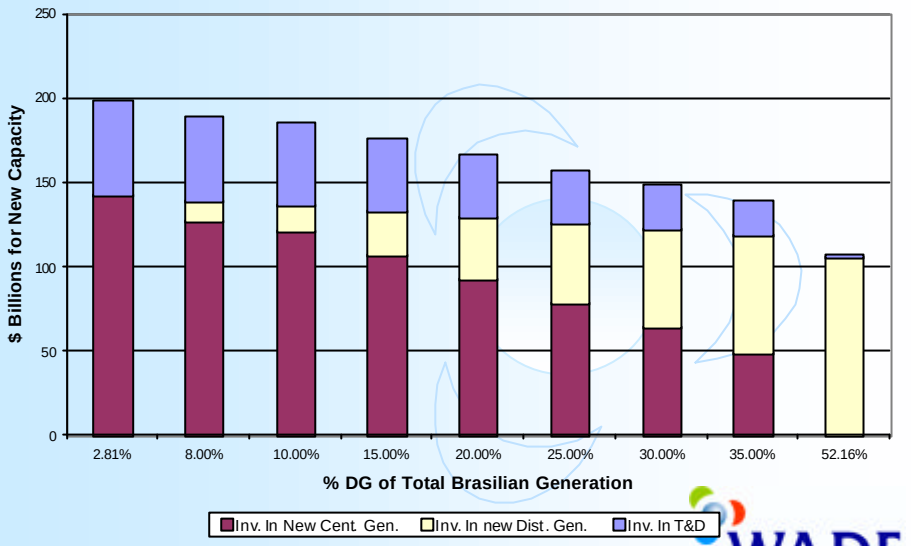
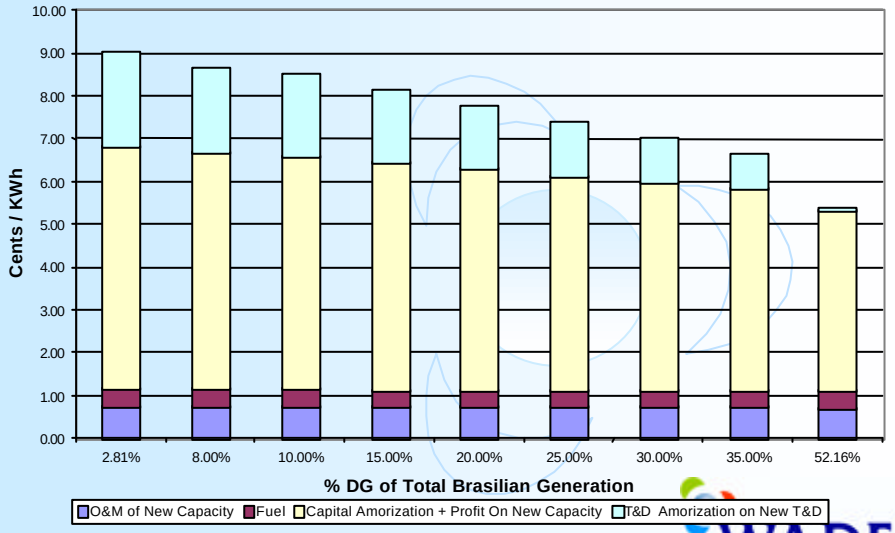
Capital Cost to Supply 2020 Electric Load Growth

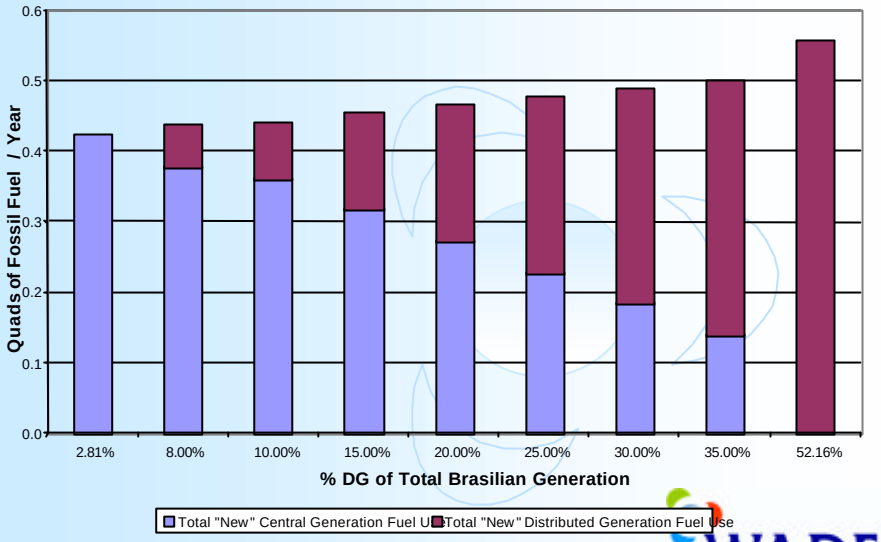


Retail Costs per KWh for Incremental 2020 Load

In 2000 dollars



Added Annual Fossil Fuel Use for Incremental 2020 Load



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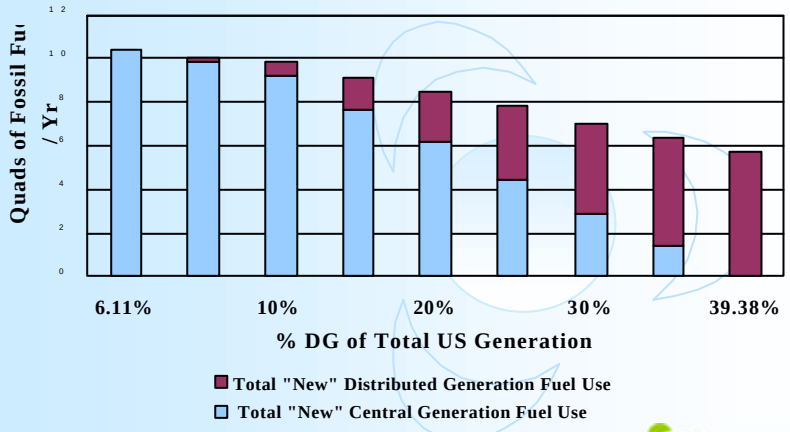

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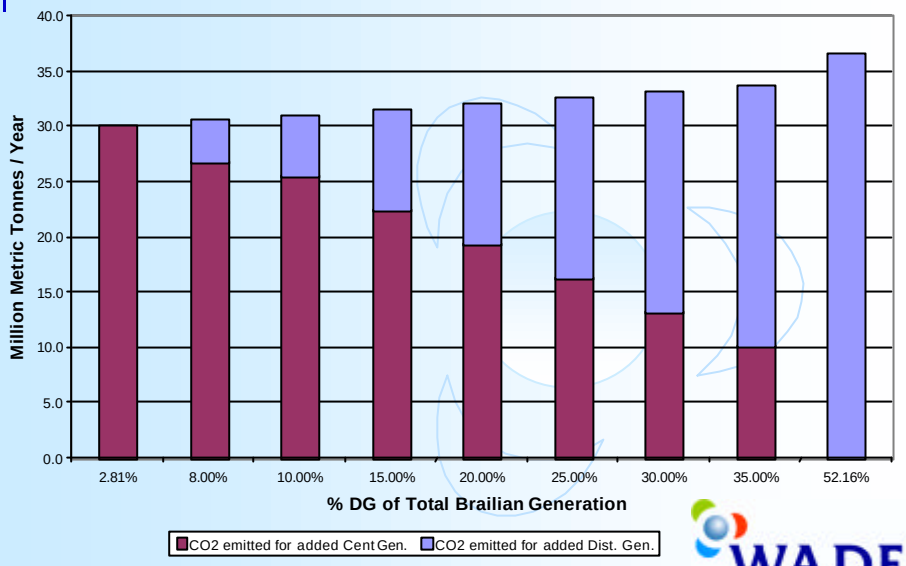
Added Annual CO2 Emissions for Incremental 2020 Load



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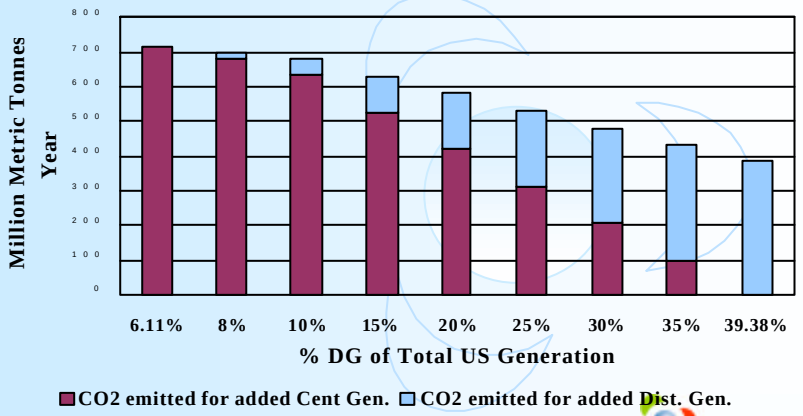

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DG as % of Total Brasilian Generation

Impact of Generating 2020 Load Growth with Central or Decentralized Generation

	100% CG	100% DG	Savings	% Change
Total Capital Cost (Capacity + T&D) Billions of Dollars	$198	$107	$91	46%
2020 Incremental Power Cost Billions of Dollars	$27	$16	$11	40%
2020 Incremental Power Cost Cents / KWh	9.04	5.38	3.66	40%
Million Metric Tonnes CO_2	30	37	-7	-22%

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DG as % of Total US Generation

Impact of Generating 2020 Load Growth with Central or Decentralized Generation

	100% CG	100% DG	Savings	% Change
Total Capital Cost (Capacity + T&D) Billions of Dollars	$853	$562	$291	34%
2020 Incremental Power Cost Billions of Dollars	$149	$97	$52	35%
2020 Incremental Power Cost Cents / KWh	8.89	5.78	3.11	35%
Emissions from New Load Thousand Metric Tonnes				
NOx	255	80	175	68%
SO2	175	16	159	91%
PM10	155	146	9	5%
Million Metric Tonnes CO_2	720	387	332	46%

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Conclusions - Brasil

- Model indicates that building central plant increases costs
- For Brasil the Cost argument is conclusive:
  - DE deployment minimises capital and retail power cost
- Brasil increase every economic goal by increasing DE reliance

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