Prospects for a Low Carbon Energy Future

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World Energy Use by Fuel Type, 1980-2030

(International Energy Outlook, EIA 2008)

1 Quadrillion Btu ≈ 1.055 EJ ≈ 293.07 TWh
Global Surface Warming

Source: IPCC 2007, Climate Change, the Physical Science Basis
Cumulative CO2 Emission: Top 10 Countries in 2007

CDIAC, 2007
CO₂ Emission from the USA and China, 1979-2007
Primary Energy Consumption by Source in the US

By Source, 2007

By Major Source, 1949-2007

Source: EIA
Electricity Net Generation (TWh)

Source: EIA
Monthly Electricity Net Generation (TWh)

Source: EIA
US load diurnal variation, 2006
IEA in its 2007 alternative Policy Scenario projected the possibility of an **18-fold** increase in wind electricity generation globally by 2030.
Installed Wind Capacity for the Top 5 Countries, 1996-2008
Electricity Generation for Top 5 Wind Power Countries, 2005-2007
Percentage of Wind Electricity in the Total Electricity Generation for Top 5 Wind Power Countries, 2005-2007

Wind Energy Potential (PWh)
- 0.00 - 0.03
- 0.04 - 0.10
- 0.11 - 0.25
- 0.26 - 0.50
- 0.51 - 0.75
- 0.76 - 1.50
- 1.51 - 3.50
- 3.51 - 7.00
- 7.01 - 16.00
- 16.01 - 22.81
# Annual Wind Potential, CO2 Emission, and Current Electricity Consumption for Top 10 CO2 Emitting Countries

<table>
<thead>
<tr>
<th>No</th>
<th>Country</th>
<th>CO2 emission (million tonnes carbon)</th>
<th>Elec. Consumption (TWh)</th>
<th>Potential Wind Energy (TWh)</th>
<th>Total</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Onshore</td>
<td>Offshore</td>
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<tr>
<td>1</td>
<td>China</td>
<td>1885</td>
<td>2398.5</td>
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<td>Iran</td>
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<td>307.5</td>
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<td>130</td>
</tr>
</tbody>
</table>

Carbon emission: CDIAC, 2007; Electricity Consumption: EIA, 2005
Annual Potential Wind Electricity on a State-by-State Basis for the Contiguous U.S. Expressed as Fraction of Total Electricity Retail Sales in the State, 2006
Use wind power only to replace the coal electricity in the US
Use wind power and solar power to replace respectively 50% of the coal electricity in the US
Solar/wind combination to replace the coal electricity in the US
Onshore Wind Power Potential for China (Watts per Unit Land Area)
Onshore Wind Energy Potential and its Fraction of the Electricity Generation of Each Regional Grid for China Mainland

Constraints: Suitable areas only and CF ≥ 20%
Bus-Bar Price Estimated of Wind Electricity for China Mainland

1 US dollar ≈ 6.8 RMB
Cumulative Available Wind Electricity at Different Bus-bar Price Level for China Mainland

![Graph showing the relationship between cumulative available wind electricity and bus-bar price]
Coal Electricity

- 1 metric tons of CO2 will be emitted associated with generation of 1 MWh electricity from coal
- Bus-bar price of coal electricity will be increased by 0.1 to 0.3 RMB/kWh to capture and sequestrate the emitted carbon (100-300 RMB per metric ton of CO2)
- Additional public health cost from burning coal
Thanks!