Renewable Energy Technologies, Policies, and Finance

Judy Siegel, President, Energy and Security Group

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Overview

- Global Energy Overview
- Renewable Energy Technology and Policy Issues
- Renewable Energy Financing
The Problem is More Than Electricity

- Half the World Relies on traditional biomass for heating/cooking needs.
- **Social**: Women can spend 1/3 of their productive life collecting & transporting wood
- **Health**: Indoor air pollution kills more women/children than malaria and tuberculosis
- **Environment**: Deforestation causes environmental problems
LINK between Energy Consumption and HDI
### Commercial Energy Use and Human Development Indicators, 2002

<table>
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<tr>
<th>Indicator</th>
<th>0-20%</th>
<th>21-40%</th>
<th>41-100%</th>
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<td>Average life expectancy at birth (years)</td>
<td>59.8</td>
<td>69.0</td>
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<td>Probability at birth of not surviving to 40 (%)</td>
<td>21.7</td>
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<td>Gross school enrollment ratio</td>
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<td>Children underweight (% of population)</td>
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<td>Population without access to improved water (%)</td>
<td>20.9</td>
<td>22.9</td>
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Note: Indicators are averages weighted by population based on 64 developing countries for which data are available.

Source: IEA World Energy Outlook 2004
The Pentagon’s New Map: 
War and Peace in the Twenty-First Century

MAP KEY

MAJOR U.S. MILITARY OPERATIONS 1990-2003
(excluding humanitarian operations)
- Combat
- Show of force
- Contingent positioning, reconnaissance
- Evacuation, security
- Peacekeeping

Response data source: U.S. Military Services via
Dr. Henry N. Musser Jr. / The CNA Corporation

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Reprinted by permission of S.P. Putnam’s Sons and Thomas P.W. Bennett.
Figure 2.2  World primary energy demand by region in the Reference Scenario

- China and India
- Rest of non-OECD
- OECD
Global Energy Overview

- World primary energy demand in BAU scenario increases 45%, 2006-2030
- Fossil fuels dominate global energy use; 80% of world primary energy mix in 2030
- Fossil fuel prices rising
- Global carbon dioxide to increase > 60%; bulk to come from LDCs
Around three-quarters of the projected increase in oil demand comes from transportation; 90% comes from petroleum.
World Oil Production by Source in the Reference Scenario

64 mb/d of gross capacity needs to be installed between 2007 & 2030 – six times the current capacity of Saudi Arabia – to meet demand growth & offset decline.
What Could the Market Look Like?

Energy supply, exajoules

1500

1000

500

0

1860 1900 1940 1980 2020 2060

Surprise
Geo/ocean
Solar
New biomass
Wind
Nuclear
Hydro
Gas
Oil & NGLs
Coal
Traditional biomass

Source: Royal Dutch Shell Group
While technological progress is needed to achieve some emissions reductions, efficiency gains and deployment of existing low-carbon energy accounts for most of the savings.
Renewable Energy Status
Figure 1. Renewable Energy Share of Global Final Energy Consumption, 2006

- Fossil fuels, 79%
- Renewables, 18%
  - Nuclear, 3%
  - Biofuels, 0.3%
  - Power generation, 0.8%
  - Hot water/heating, 1.3%
  - Large hydropower, 3%
  - Traditional biomass, 13%

Figure 7. Renewable Power Capacities, Developing World, EU, and Top Six Countries, 2006


Note: Excludes large hydropower
Figure 11. Annual Investment in New Renewable Energy Capacity, 1995–2007


Note: Excludes large hydropower.
Figure 6. Solar PV, Existing World Capacity, 1995–2007

Figure 8. Share of Solar Hot Water/Heating Capacity Existing, Selected Countries, 2006

- China: 64.5%
- European Union: 12.8%
- Turkey: 6.3%
- Japan: 4.5%
- Israel: 3.6%
- United States: 1.7%
- Australia: 1.2%
- India: 1.1%
- South Africa: 0.2%
- Other: 1.9%

Total = 105 gigawatts-thermal

Figure 10. Ethanol and Biodiesel Production, 2000–2007

**Renewable Energy: Addressing the Barriers**

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<tr>
<th>Category</th>
<th>Issues</th>
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| **Capacity Building**     | - Institutional Capacity Building: individuals/institutions-public, private, NGOs  
                           |   - SMEs to source, integrate, install, operate, maintain, and service RE systems  
                           |   - Assessment Tools and Performance Specifications  
                           |   - Consumer awareness/engagement                                        |
| **Finance**               | - High first costs of RE versus competing technologies  
                           |   - Funding Support (prefeasibility, feasibility, loans, equity, insurance)  
                           |   - Risk perception and investor confidence  
                           |   - Attracting Local FIs, MFIs, Carbon Finance; donor coordination  
                           |   - Lack of International Investment, risk mitigation, fluctuating currencies |
| **Technology Transfer /R&D** | - Technology Awareness/Development / Cooperation  
                           |   - Lack of R&D funding  
                           |   - Grid Integration issues; Concerns over aesthetics, noise,  
                           |   - Resource Assessment, Product Standardization/, and Harmonization       |
| **Policy Support**        | - Political Support for Consistent RE Policies (long term, reliable, predictable)  
                           |   - Immature Regulatory Responses  
                           |   - Fossil Fuel Subsidies                                                  |
What is the Role of Policy Interventions?

- Supportive public policies, legal, and regulatory frameworks:
  - Reduce investor risks
  - Level the playing field for delivery of cost effective, cleaner energy services
  - Contribute to technology scale-up and replication

- Address policy biases
  - Subsidies for Conventional Fuels
  - Lack of Accounting for External Costs
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<th>Feed-in tariff</th>
<th>Renewable portfolio standard</th>
<th>Capital subsidies or grants</th>
<th>Investment or other tax credits</th>
<th>Sales tax or excise tax reduction</th>
<th>Energy tax or VAT</th>
<th>Tradable renewable energy certificates</th>
<th>Energy production payments or tax credits</th>
<th>Net metering</th>
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Financing Renewable Energy
Variety of Potential Financing Sources for Renewable Energy

- National Governments
- Multilateral Funding Sources
- International & Domestic Financing Institutions
- Bilateral Agencies
- Foundations

However, cannot ignore that global financial climate has hurt renewable energy investments.
National Governments

- Several developing country governments, especially among emerging market economies, have instituted large scale RE programs.

Examples include:

- China targeting 15% of energy supply from RE by 2020, not counting large hydro.
- India targeting 10% of power supply from RE by 2012.
- Other countries such as Thailand, Malaysia, Philippines, have programs underway/in planning.
## World Bank Group

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<th>Organization</th>
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<td>International Bank for Reconstruction and Development (IBRD)</td>
<td>- Works with governments in middle income and creditworthy poorer countries</td>
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<td>- Provides loans, guarantees, analytic, and advisory services</td>
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<tr>
<td>International Development Association (IDA)</td>
<td>- Works with governments in 81 poorest countries providing highly concessional financing</td>
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<td>- Provides interest-free credits and grants</td>
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<td>International Finance Corporation (IFC)</td>
<td>- Works with the private sector</td>
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<td>- Invests in private enterprises in developing countries</td>
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<td>- Provides long term loans, guarantees, and risk management and advisory services</td>
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<tr>
<td>Multilateral Investment Guarantee Agency (MIGA)</td>
<td>- Provides political risk insurance against non-commercial risks to eligible foreign investors and commercial banks for qualified investments in member countries</td>
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World Bank and Clean Energy

- WB is actively supporting clean energy technology solutions
- Since 1990, The WBG committed >14.5B to RE/EE
- Includes $4.4B for EE, $3.8B for RE, $6.2B for large hydro
- From 2005-2008, RE/EE accounted for 35% of total energy sector lending
- New funds emerging: Climate Technology Fund, Renewable Energy Fund
## Other World Bank-Related Activities in Renewable Energy

| Energy Sector Management Assistance Program (ESMAP) | - Global technical assistance program and knowledge partnership  
- Sponsored by bilateral donors, UNF, UNDP  
- Managed by World Bank |
|-----------------------------------------------------|---------------------------------------------------------------|
| Asia Sustainable and Alternative Energy Program (ASTAE) | - Established in 1992 by World Bank and bilateral donors  
- Provides upstream Economic and Sector Work  
- Provides assistance in RE project identification, preparation, and supervision |
Clean Development Mechanism (CDM)

- CDM an arrangement under the Kyoto Protocol allowing industrialized countries with GHG commitments to invest in LDC projects that reduce emissions
- CDM/emerging carbon market offer RE revenue stream
- RE accounts for 60% of projects
- 70% of CDM projects from Asia
- CDM projects/credits can be organized at gov’t level; & subject to gov’t approval, at private enterprise level
- Much of carbon investment expected to flow thru carbon funds
- WBG Carbon Finance business manages many carbon funds
- National carbon funds emerging as are 100% private funds
- EU Emissions Trading Scheme could be added source of carbon investment
- Programmatic approach may help bundle carbon credits/processing
Global Environment Facility

- GEF established in 1991, to help developing countries fund projects/programs that protect the global environment
- GEF grants support projects related to biodiversity, climate change, international waters, land degradation, the ozone layer, and persistent organic pollutants
- Works through implementing agencies: WBG, UNDP, UNEP, UNIDO, etc.
- Considers RE “no-regrets” climate change mitigation solution
- To date, invested $1 billion in RE; plans are to invest at least $100 million per year on RE in future lending program
Asian Development Bank

- ADB a major lender for infrastructure/environment in Asia
- Previously lent to Governments, but increasing focus on private sector; provides loans and TA support
- ADB is accelerating focus on RE/EE (or clean energy)
  - Country-level activities, sector reform, regional programs
  - In July 2005, created the Clean Energy Initiative to develop a strategy for annual investments of $1 billion/year over next 5 years
  - Mobilized donor funds to support capacity building, institutional development, & project development in RE/EE
  - In 2008, established Seed Capital Assistance Facility with UNEP and GEF ($4.2 M)
## ADB’s Clean Energy Investment

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<tr>
<td>2003</td>
<td>1,263</td>
<td>226</td>
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<td>2004</td>
<td>1,356</td>
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<td>2005</td>
<td>1,785</td>
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<td>2006</td>
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<td>2007</td>
<td>1,801</td>
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<td>2008</td>
<td>3,023</td>
<td>1,693</td>
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</tbody>
</table>
United Nations

- Approximately 20 UN agencies have programs supporting renewable energy

- Activities include:
  - Technical assistance and training
  - Institutional development
  - Capacity building
  - Policy development
  - Power sector reform
  - Energy access and poverty reduction
# UN Member Agencies with Renewable Energy Activities

<table>
<thead>
<tr>
<th>Economic Commission for Africa (ECA)</th>
<th>United Nations Educational, Scientific and Cultural Organisation (UNESCO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic Commission for Europe (ECE)</td>
<td>United Nations Environment Programme (UNEP)</td>
</tr>
<tr>
<td>Economic Commission for Latin America and the Caribbean (ECLAC)</td>
<td>United Nations Framework Convention on Climate Change (UNFCCC)</td>
</tr>
<tr>
<td>Economic and Social Commission for Asia and the Pacific (ESCAP)</td>
<td>United Nations Industrial Development Organisation (UNID)</td>
</tr>
<tr>
<td>Economic and Social Commission for Western Asia (ESCWA)</td>
<td>United Nations International Research and Training Institute for the Advancement of Women (INSTRAW)</td>
</tr>
<tr>
<td>The Food and Agriculture Organisation (FAO)</td>
<td>World Health Organisation (WHO)</td>
</tr>
<tr>
<td>The International Atomic Energy Agency (IAEA)</td>
<td>World Meteorological Organisation (WMO)</td>
</tr>
<tr>
<td>United Nations Conference on Trade and Development (UNCTAD)</td>
<td>Department of Economic and Social Affairs (DESA)</td>
</tr>
<tr>
<td>United Nations Development Programme (UNDP)</td>
<td><strong>Green: More Active Programs in RE</strong></td>
</tr>
</tbody>
</table>
International & Local Financial Institutions

- Some international and many domestic financial institutions have been supporting RE in developing countries
- Several existing and emerging risk-mitigation facilities/instruments aimed at increasing their participation

**International FIs:**
- Fortis, Rabobank, Australia and New Zealand Banking Group, offer large scale RE finance in emerging markets, primarily Asia
- Triodos Bank investing in RE companies in Africa/Asia

**Domestic FIs:**
- More active in financing RE in developing countries, often operating multilateral or bilateral credit lines
- Examples include IREDA, Yes Bank, Canara, Syndicate Bank in India; China Development Bank; Development Bank of Philippines; Thai TMP Bank; CAPIE in Central America
- Microfinance can also be a key option

- Much more work needed to engage International and Domestic FIs
Bilateral Development Agencies

- Export Credit Agencies have not been particularly active in LDCs should change; in 4/05 agreed to extend payment terms for RE to 15 years
- KfW (Germany) one of the most active development banks financing RE
  - Set up special facility for RE/EE that will make available 500 million euros in 2005-9 for up to 50 investment projects (low interest loans)
  - GTZ, development agency also active: providing TA, in-kind support
- USAID promotes clean energy access (technology neutral) but has supported RE projects in a number of developing countries worldwide
- Other bilaterals active in RE in LDCs are: Australia, Canada, Denmark, French, Germany, UK, Netherlands, Norway, Sweden
- The EU is a major supporter of RE in developing countries
  - EUEI supporting renewable energy projects
  - Set up Global RE Fund of Funds (GREFF) to support several investor-financed funds
Partnerships and Foundations Supporting RE

**Partnerships**
- Global Village Energy Partnership (GVEP)
- Renewable Energy and Energy Efficiency Partnership (REEEP)

**Foundations**
- Blue Moon Foundation
- Energy Foundation
- Rockefeller Brothers
- Shell Foundation
- UN Foundation
Conclusions

- Funding is available, but with conditions
- Tap into local capital markets
- Design regulations that encourage foreign investment
- Strengthen legal system to permit enforcement of contracts
- Be patient and persistent
Thank you

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