



FINLAND FUTURES
RESEARCH CENTRE

CUBAN ENERGY REVOLUTION AND FUTURE ROLE OF RENEWABLE ENERGY

REFORM Group Meeting

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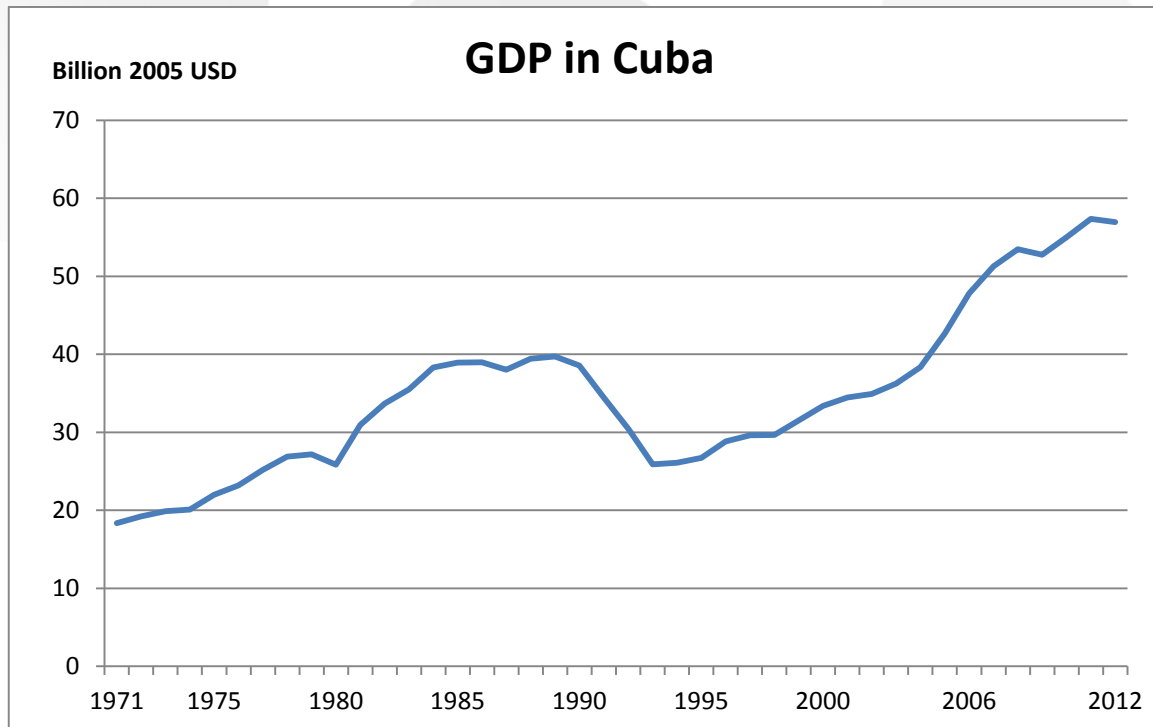
Contents

- Cuban development and energy use
- Cuban energy revolution
- Drivers of CO₂ emissions
- Future energy scenarios for Cuba

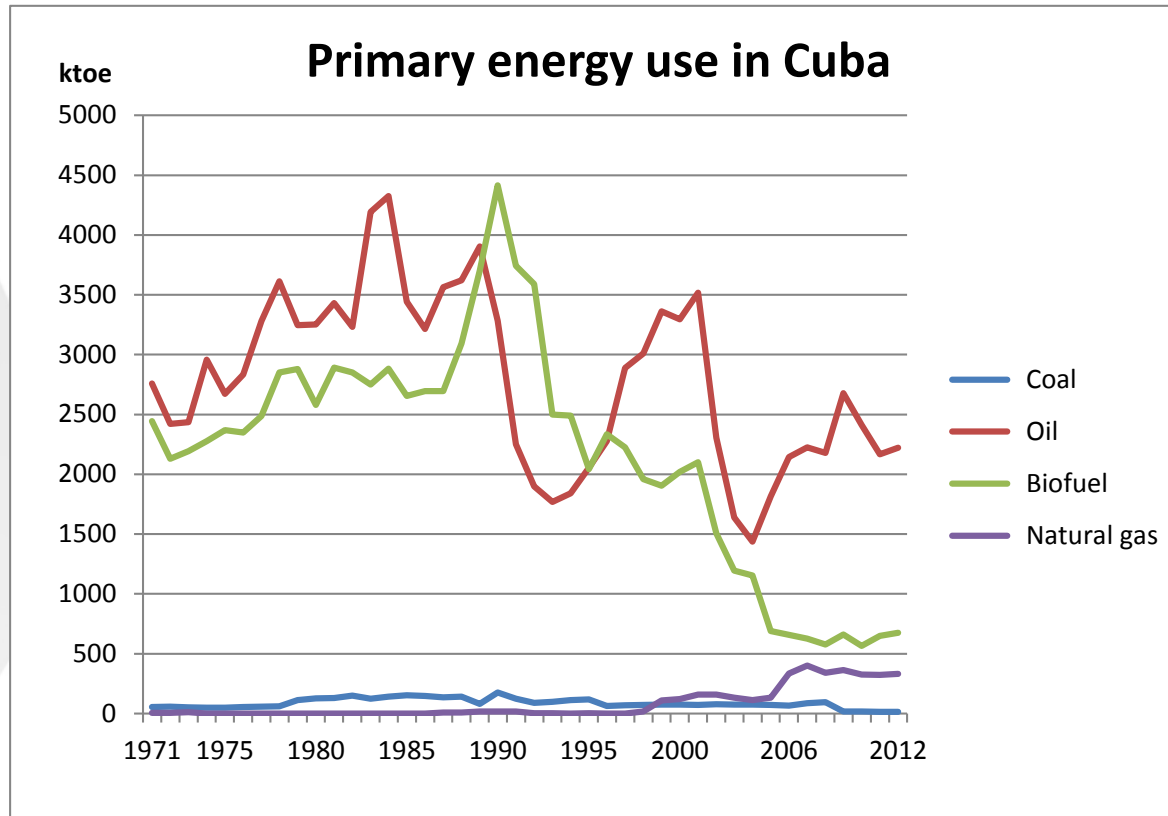
Vazquez, L., Luukkanen, J., Kaisti, H., Käkönen, M. and Majanne, Y. (2015) Decomposition analysis of Cuban energy production and use: Analysis of energy transformation for sustainability. *Renewable and Sustainable Energy Reviews* 49 (2015) 638–645. ISSN: 1364-0321

Cuban development

- Prior to the Cuban revolution in 1959, about half of the households were connected to electricity grid.
- By 1989, this number had risen to 95 per cent
- Trade with Soviet Union essential for Cuban economic development
- Collapse of Soviet Union 1991 -> Huge impact on Cuban economy

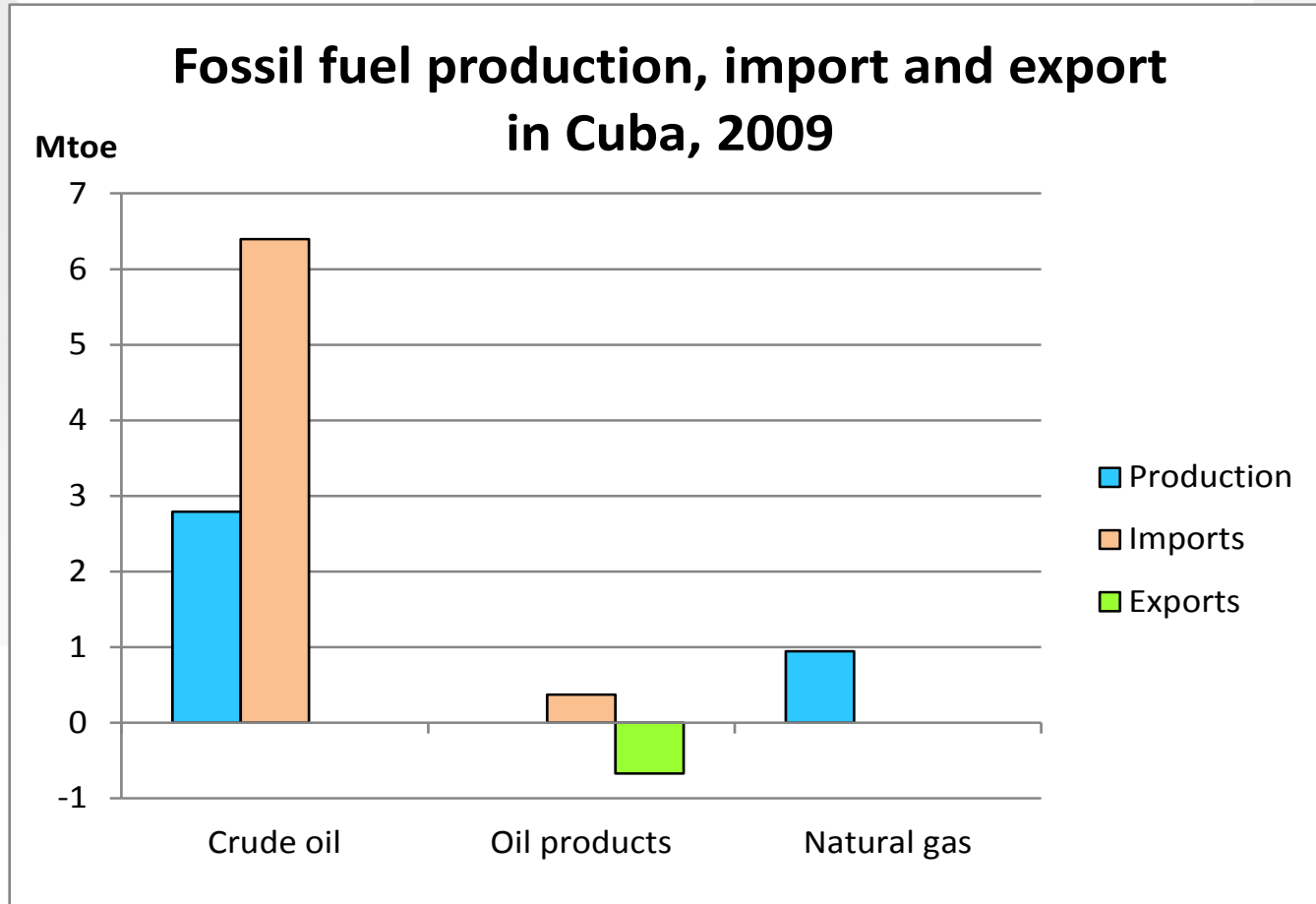


Cuban energy use

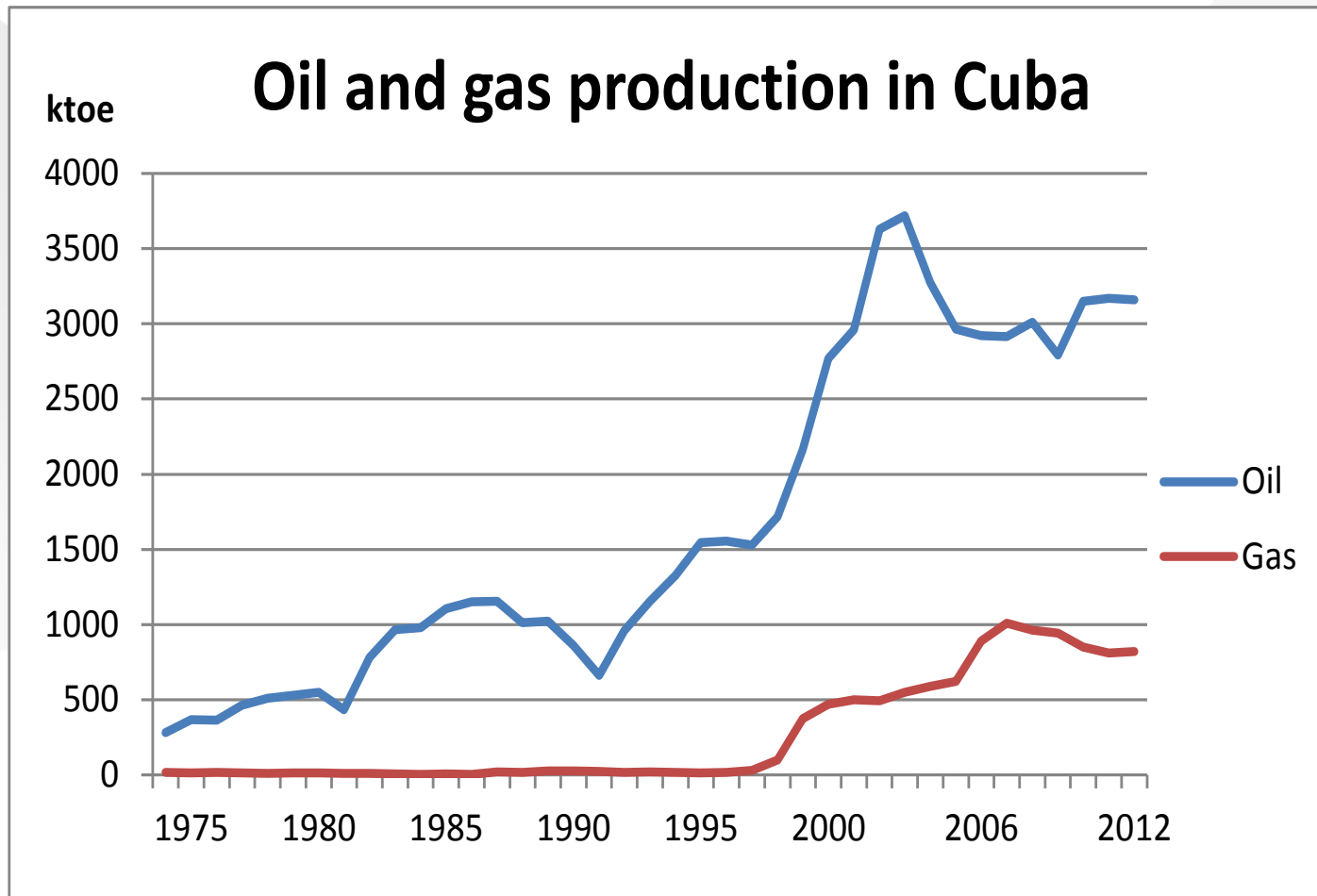


- Reduction of Soviet oil import 1991
- Import of Venezuelan oil
- Reduction in sugar production reduced biomass use (bagasse)

Cuban energy production



Cuban energy production



Cuban energy problems

- In the early-2000s Cuba's energy situation was bleak
- Cuba had centralized and inefficient power plants
- 11 thermoelectric plants that functioned about half of the time.
- Use of poor quality fuel with high content of sulphur.
- There were frequent blackouts and high transmission line losses
- In 2004 hurricanes in Cuba, a million people without electricity for 10 days
- Decision to start energy revolution

Revolución Energética Energy Revolution

- (i) Energy efficiency and conservation;
- (ii) Increasing the availability and reliability of the national grid;
- (iii) Incorporating more renewable energy technologies into its energy portfolio;
- (iv) Increasing the exploration and production of local oil and gas;
- (v) International co-operation.



Revolución Energética Energy Revolution

- Change over to energy efficient appliances.
- Households switched incandescent light bulbs to more efficient compact fluorescents free of charge.
- 2 million refrigerators and one million fans were replaced,
- 3.5 million rice cookers and
- 3 million pressure cookers were bought
- New residential electricity tariff was introduced to encourage electricity saving

Efficiency improvement



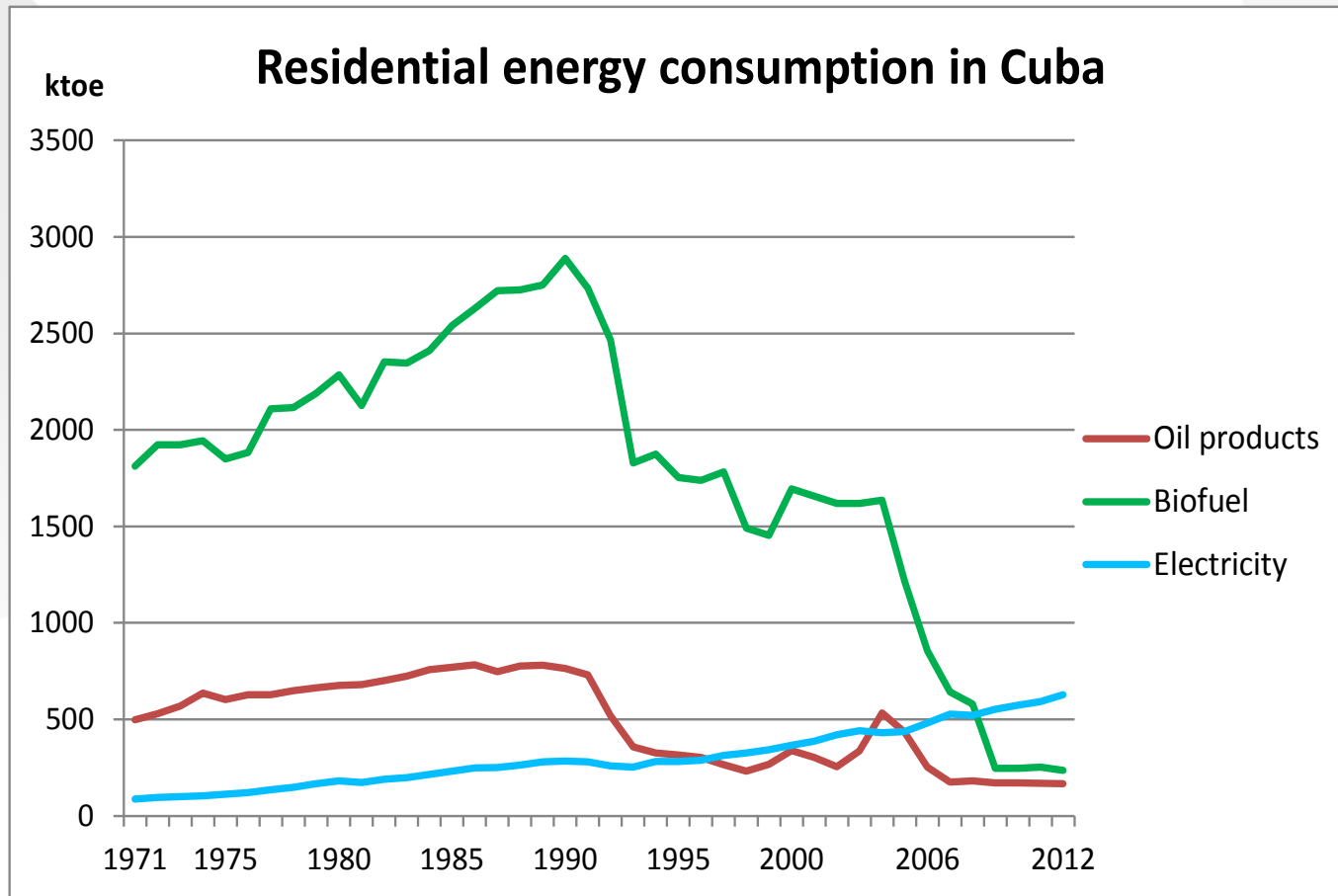
Switch from kerosene to electric cooking

Energy efficiency



- Reduction in LPG use
- Rice cookers
- Pressure cookers

Revolución Energética Energy Revolution



Solar development



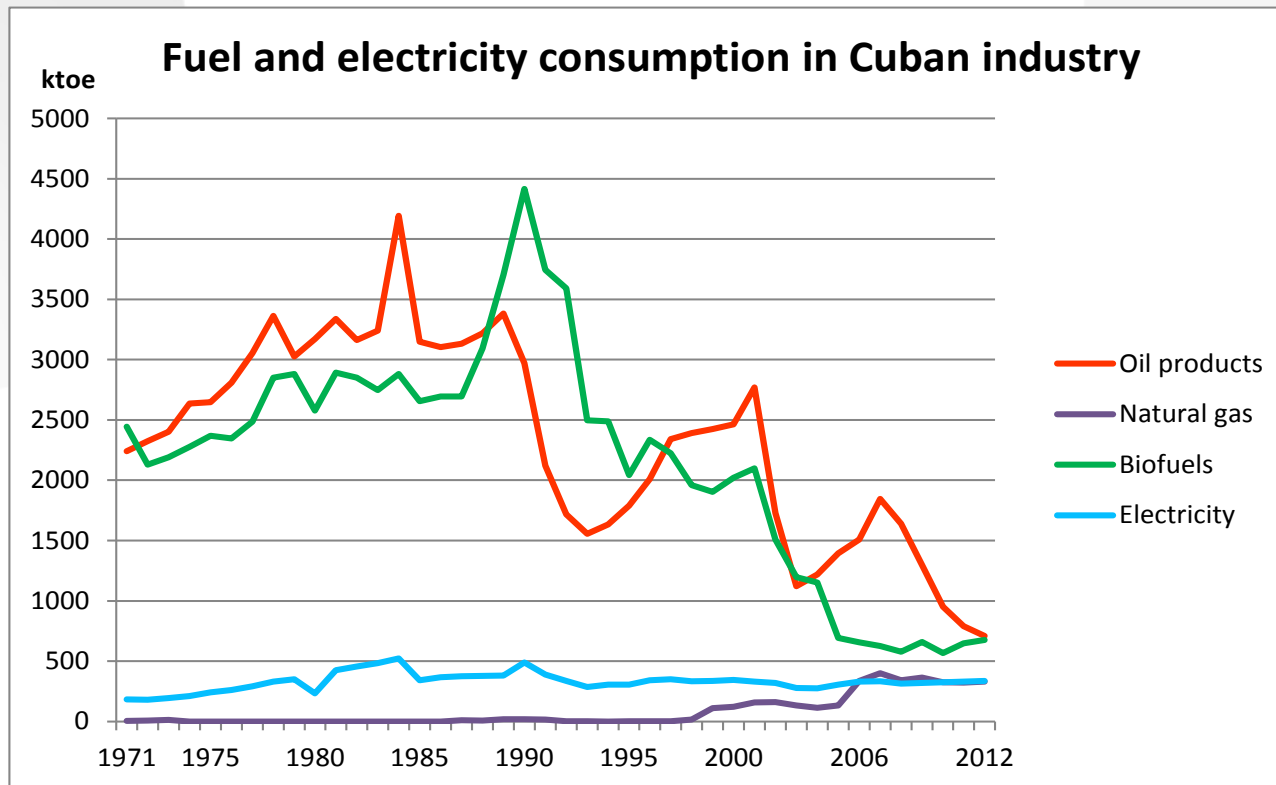
- Solar PV development
- Two large scale solar PV plants
- 1 MW + 1 MW

Wind power capacity 12 MW in 2014



Revolución Energética Energy Revolution

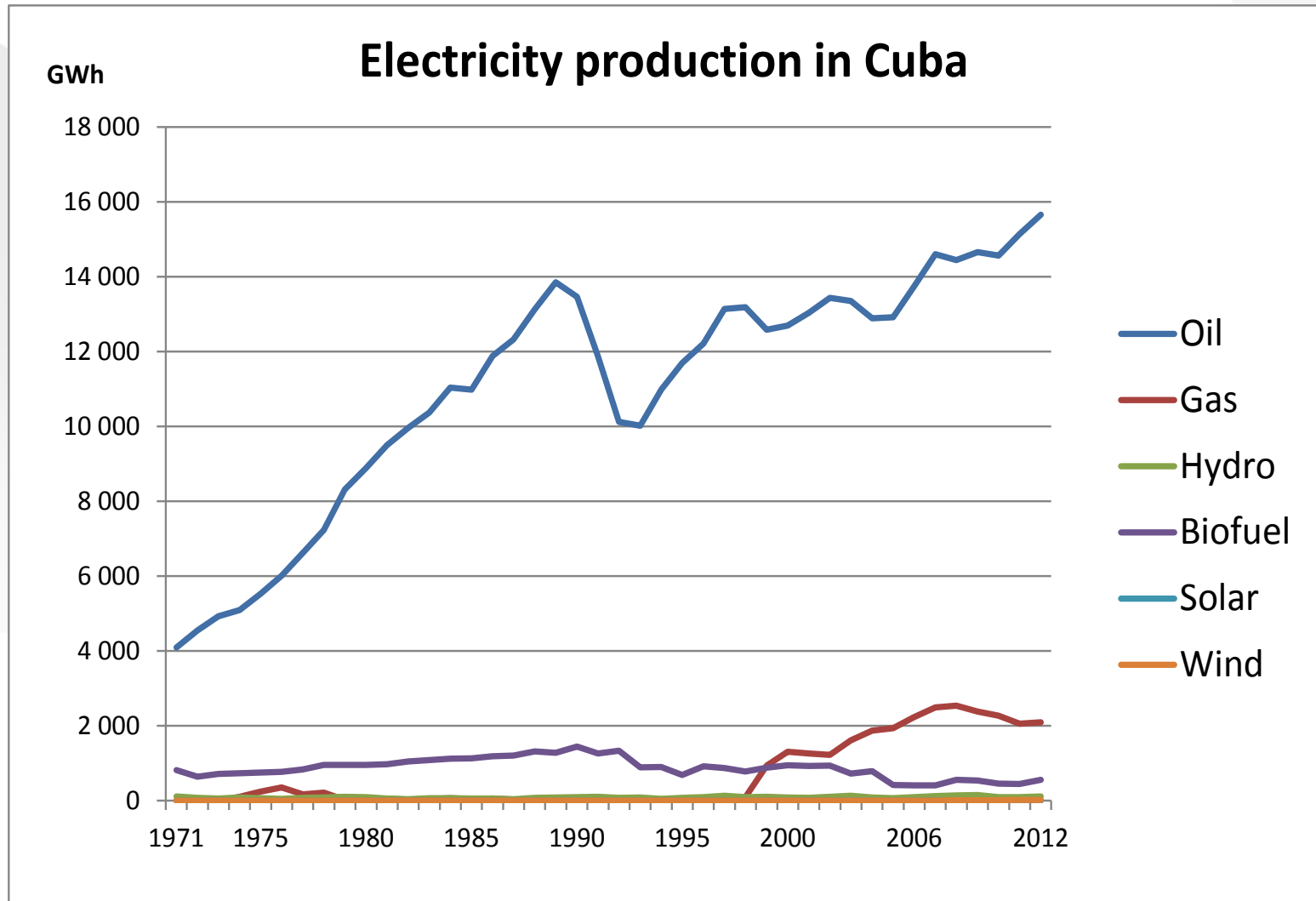
- Not much impact on industrial energy use
- No special measures in industry



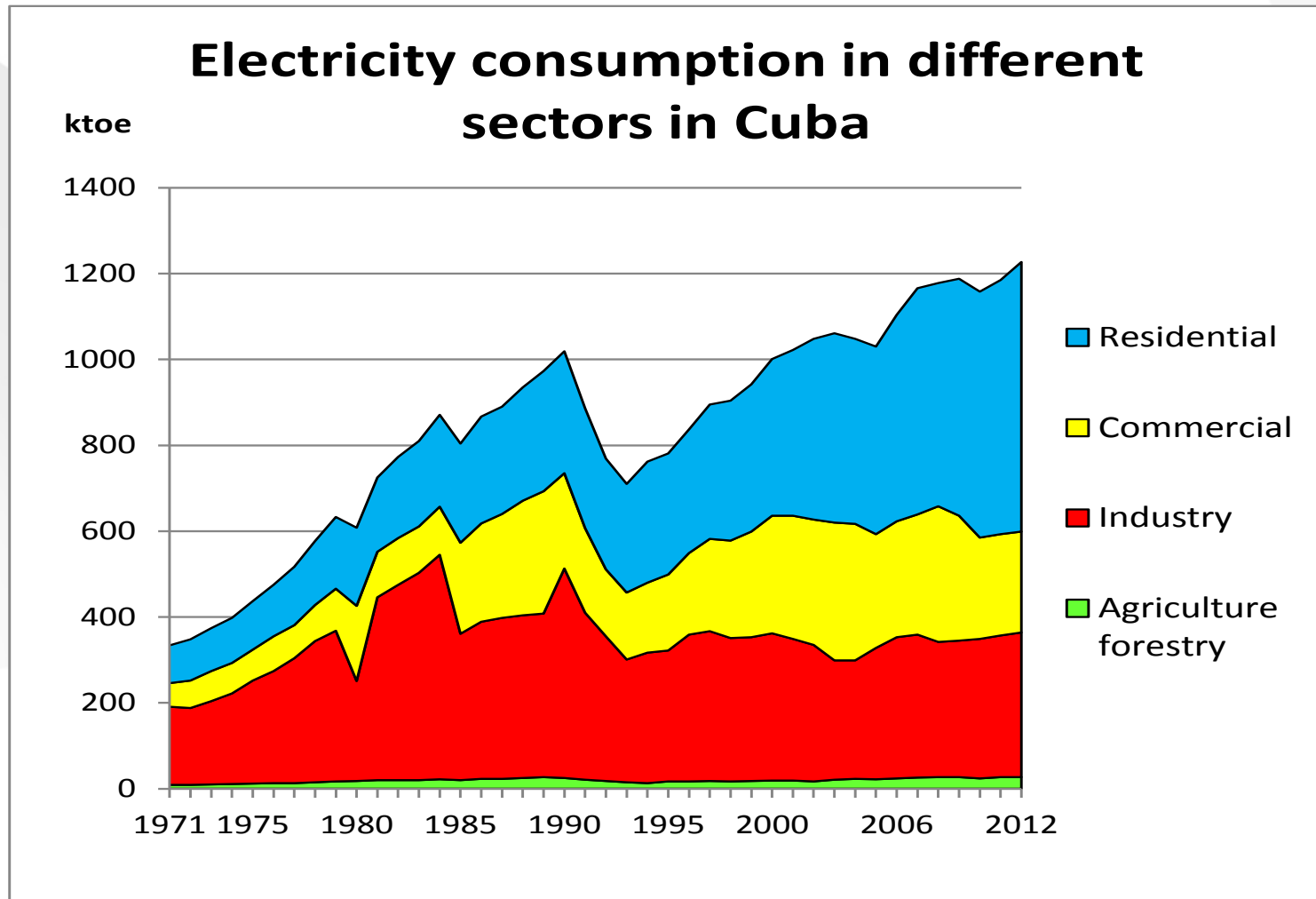
Electricity



Electricity



Electricity

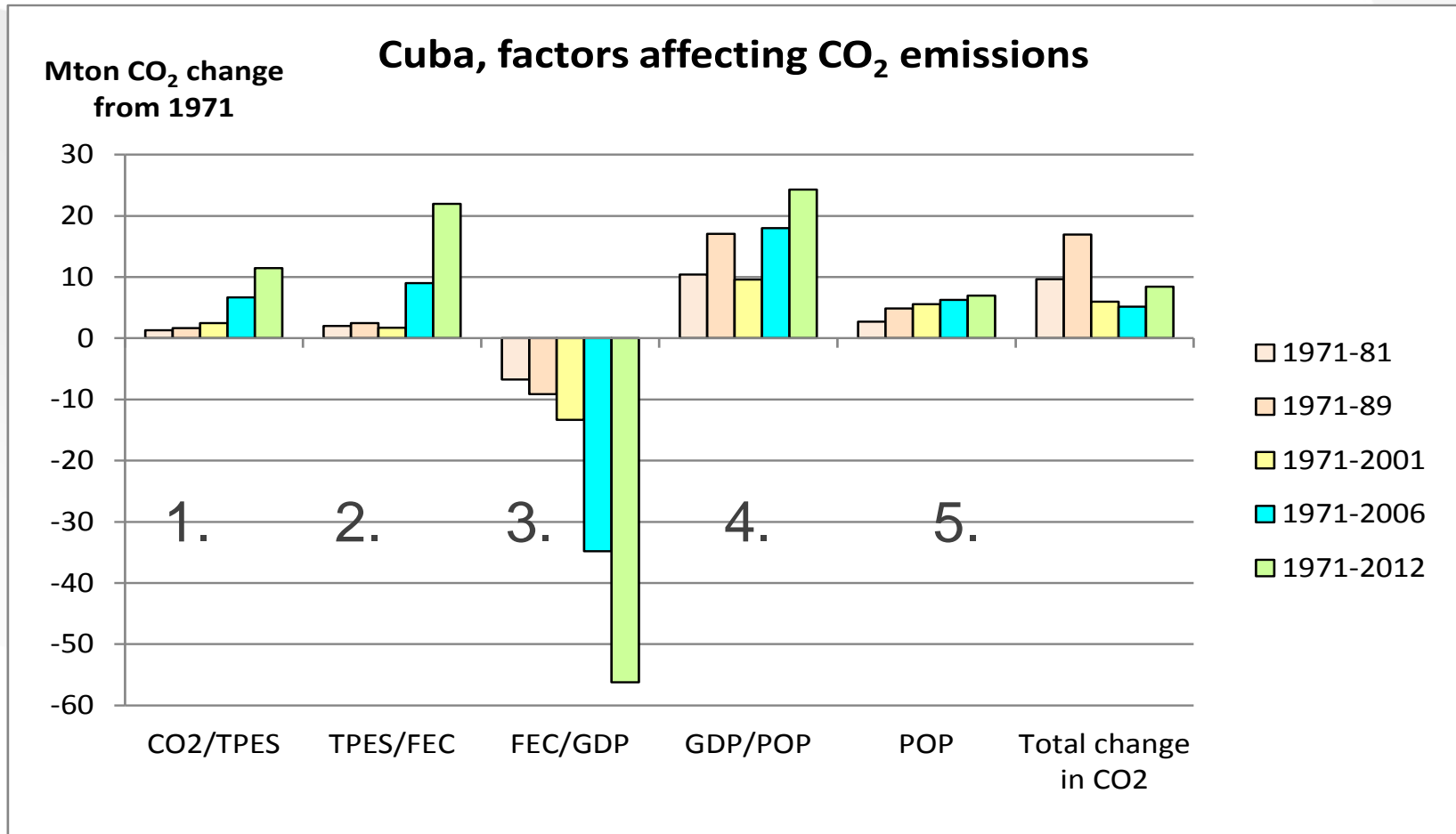


- Electricity is increasingly used in the residential sector

Renewable energy target

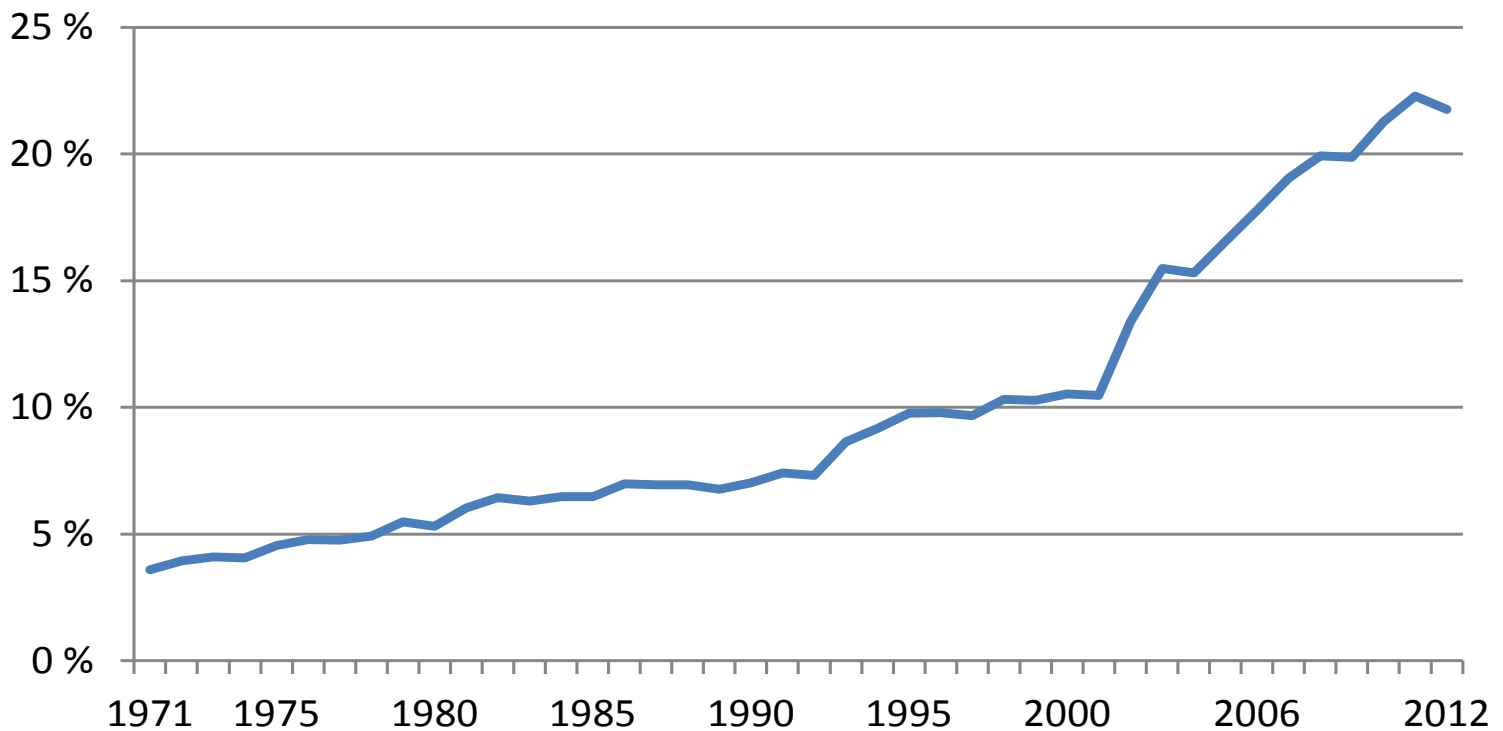
- **Target of supplying 24% of electricity needs from renewables by 2030**
- **Plans for rapid increase in wind power and solar PV**
- **Bioenergy has large potential, but not much investment plans**
- **Energy efficiency improvements are seen as one means of reducing the demand**

Decomposition of CO₂ emissions



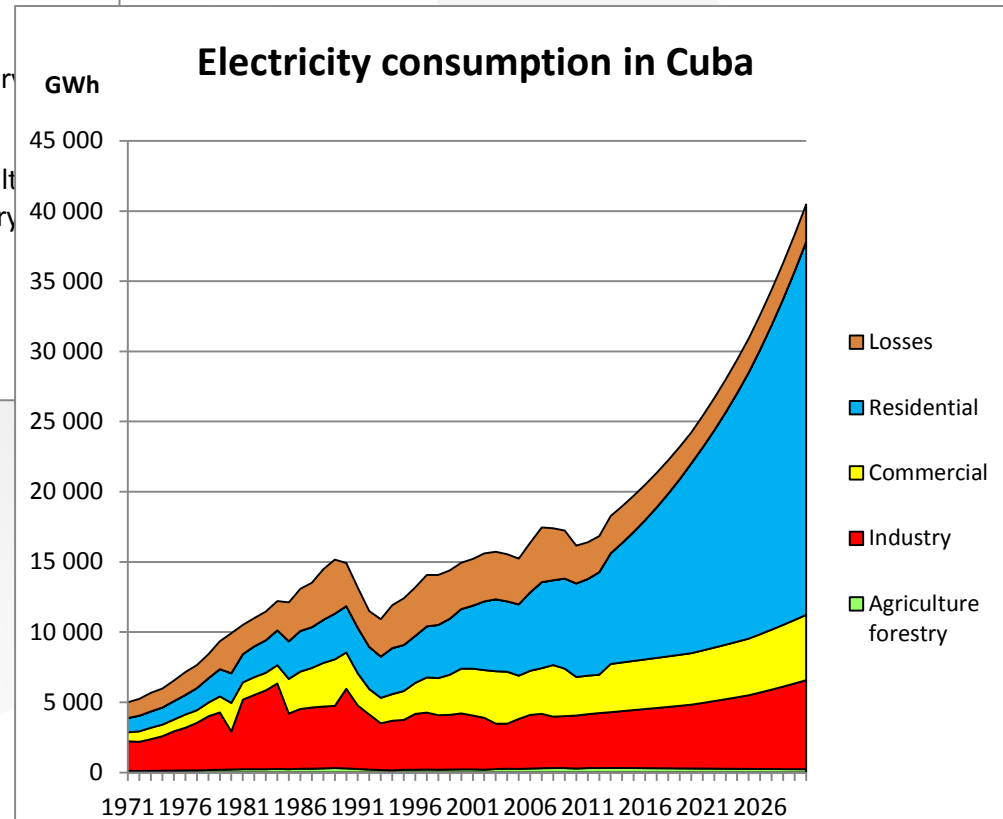
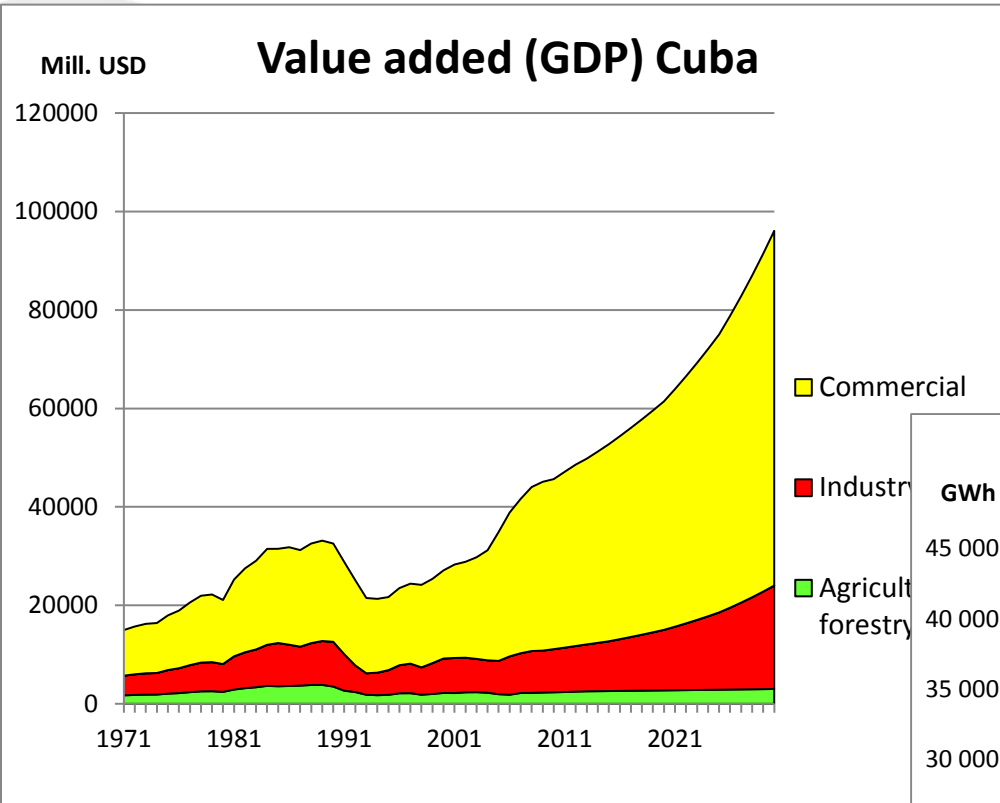
1. Shift to more fossil fuel use
2. Decreasing transformation efficiency
3. Improving efficiency of economic production
4. Increasing GDP
5. Increasing population

Share of electricity of final energy consumption in Cuba



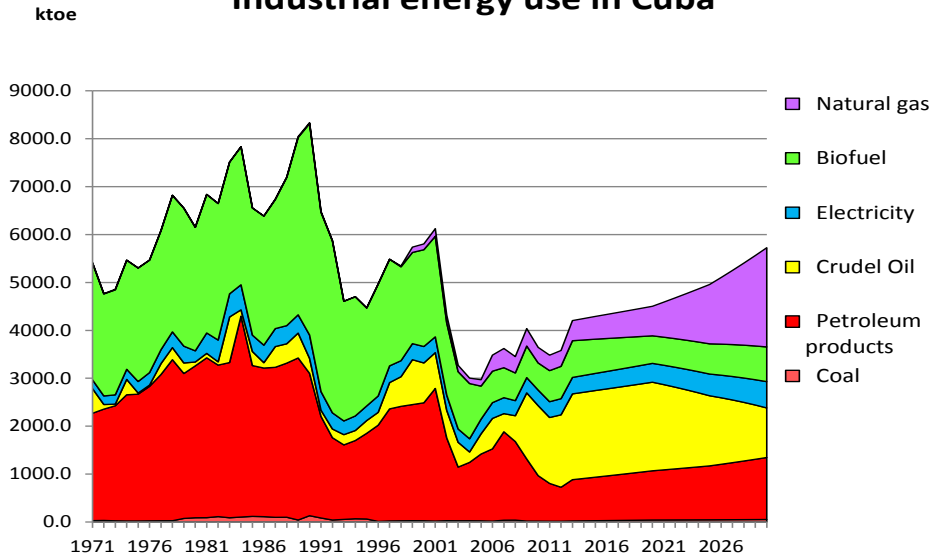
Future scenarios for Cuba

- Scenarios constructed with LINDA model
- Business-as-usual with fossil energy

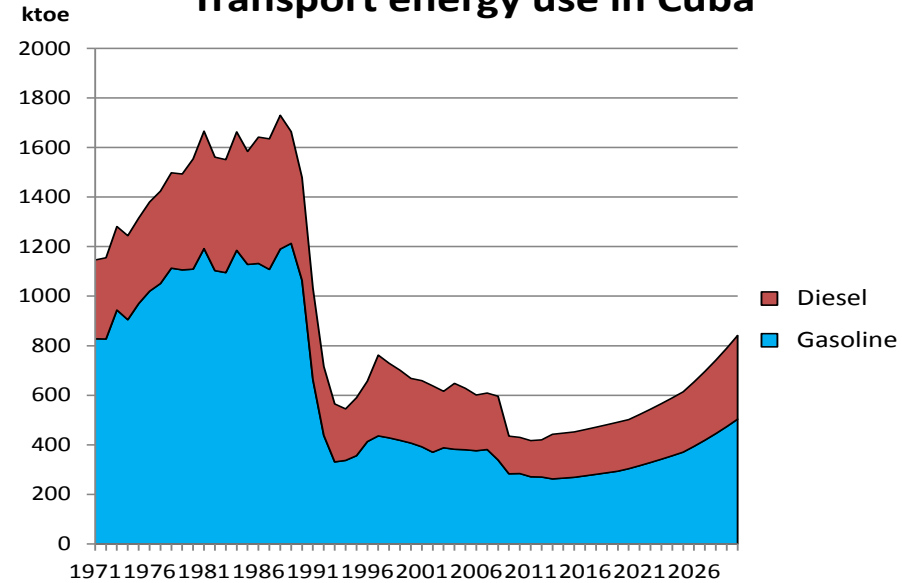


BAU fossil scenario

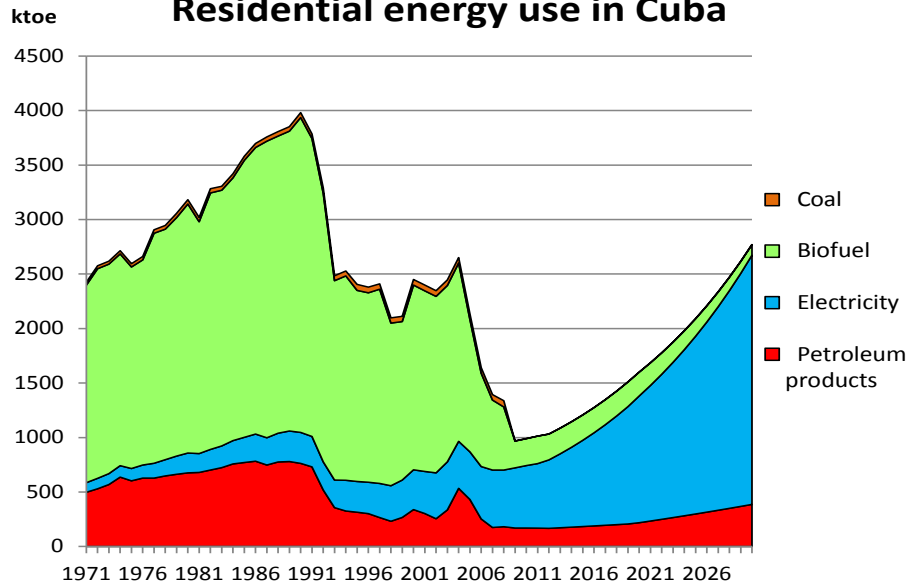
Industrial energy use in Cuba



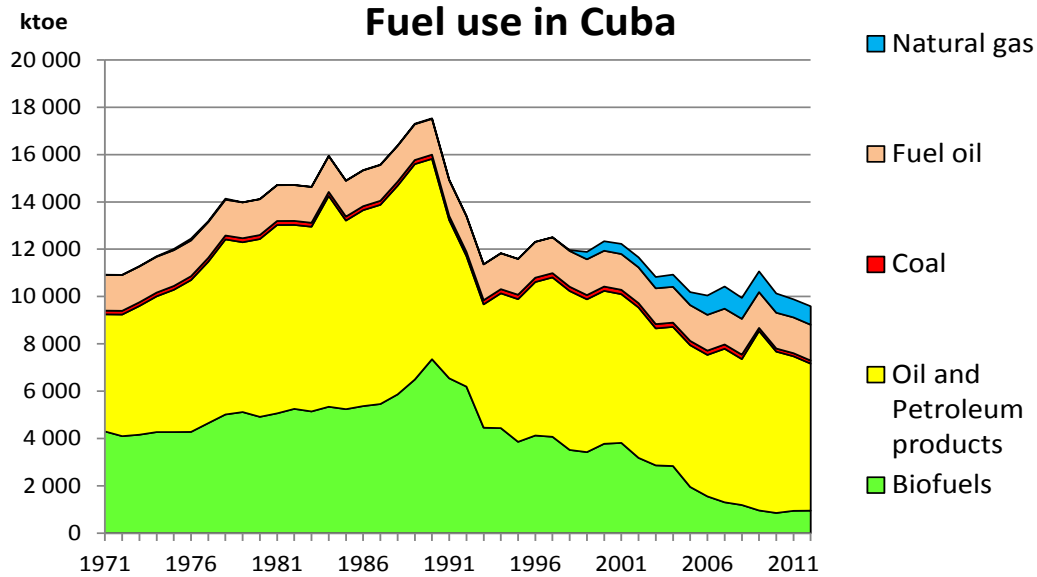
Transport energy use in Cuba



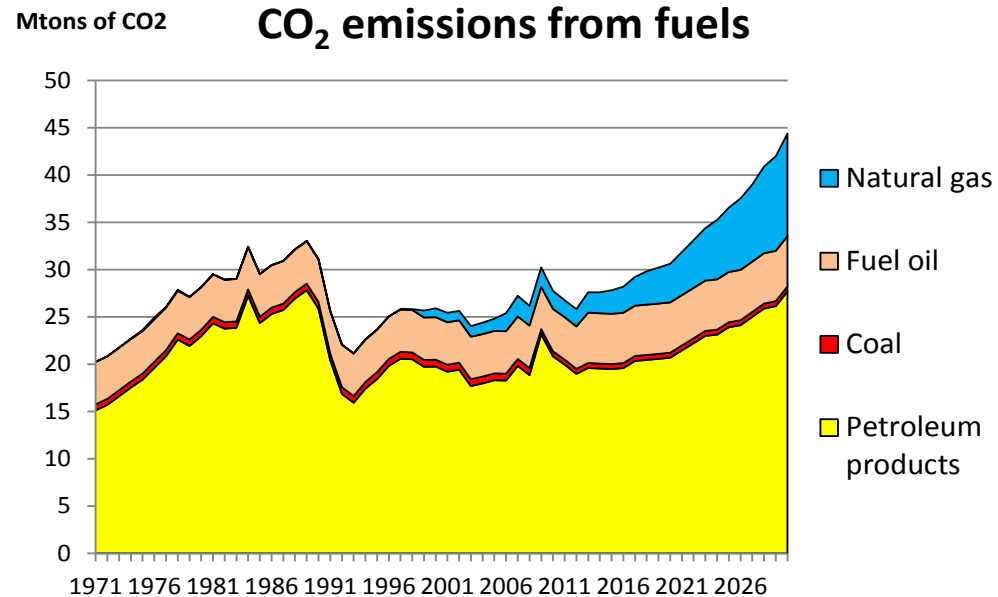
Residential energy use in Cuba



BAU scenario with fossil fuel

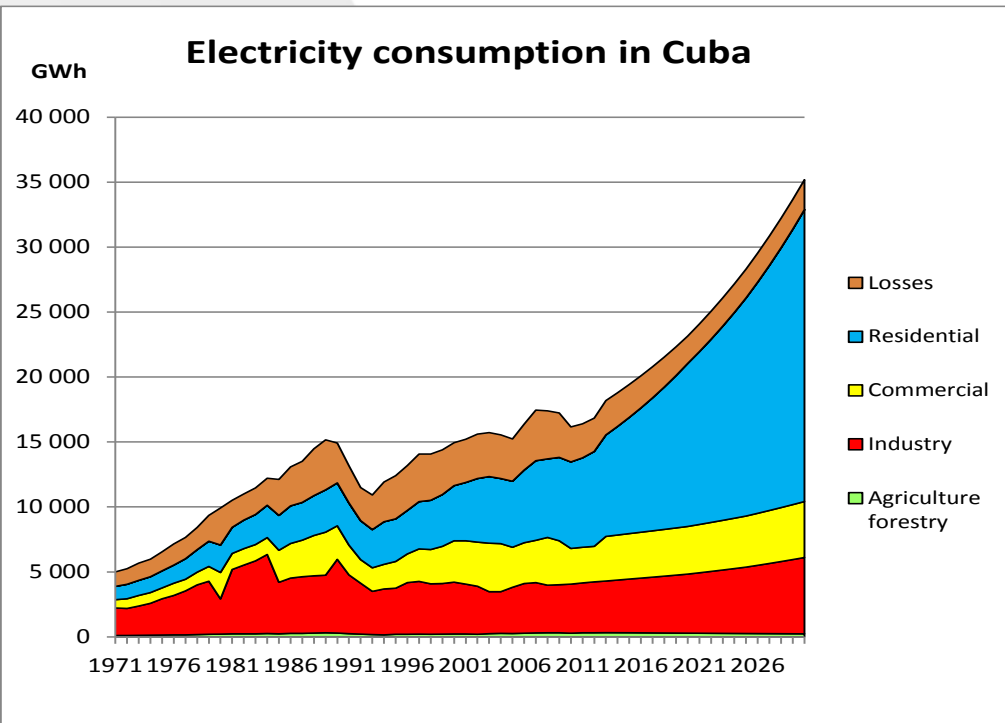


● Increase in CO₂ emissions



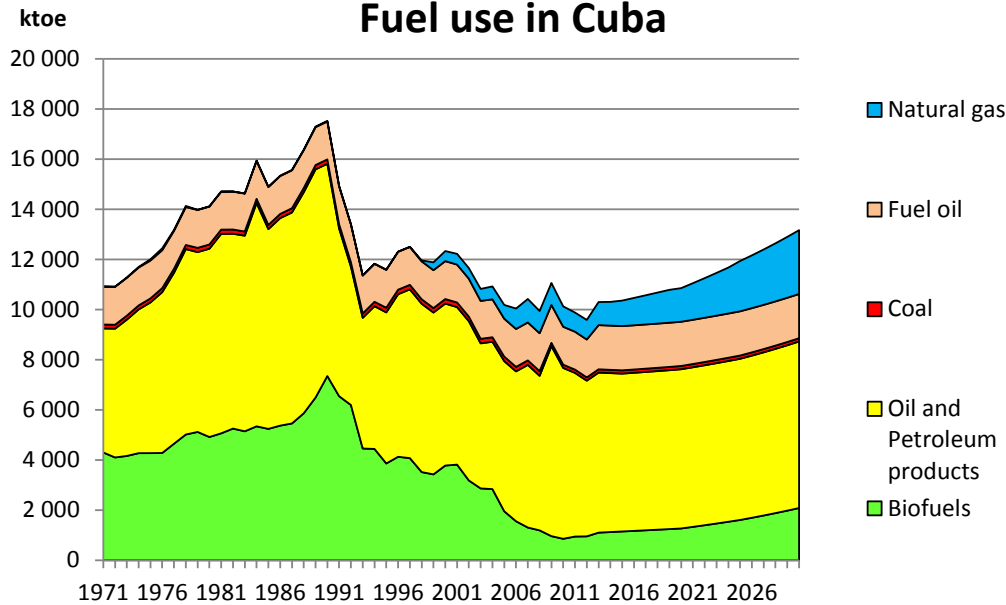
Scenario with renewables and improved efficiency

Similar economic development



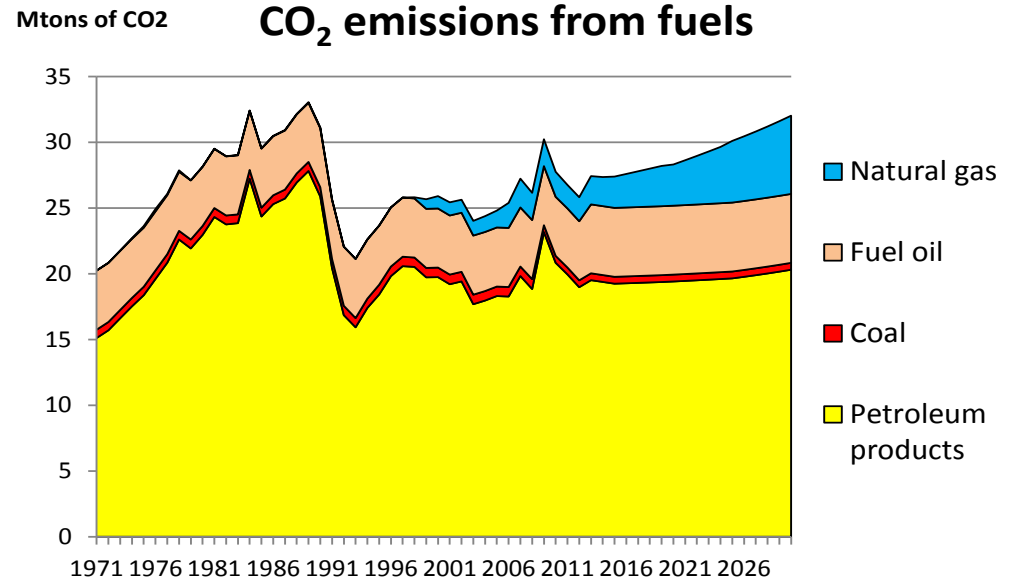
- Lower growth in electricity demand (35 TWh instead of 40 TWh) due to improved efficiency
- Large increase in wind power and solar PV production
- Considerable increase in bioenergy production

Fuel use in Cuba



- Considerable reduction in CO₂ emissions from 45 Mton to 32 Mton

CO₂ emissions from fuels



Conclusions

- There is considerable potential in renewable development in Cuba
- Large investments are needed with increasing energy demand in order to reduce CO₂ emissions
- Development of domestic oil and gas resources may hinder renewable development especially if import substitution or export revenues are possible

Thank you



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