TITLE

KYOTO PROTOCOL OBJECTIVES BY PROMOTING THE TECHNOLOGY TRANSFER TO SMALL ISLAND DEVELOPING COUNTRIES:

How to Help Investment in Developing Countries

The Case of SANTO ANTÃO, CAPE VERDE

Neven Duic
Luís Manuel Alves
Maria da Graça Carvalho

Instituto Superior Técnico, Technical University of Lisbon
Dept. Mechanical Engineering
Av. Rovisco Pais, 1049-001 Lisbon, PORTUGAL

BACKGROUND

Article 4.5 of the United Nations Framework Convention on Climate Change

"The developed country Parties ... shall take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly developing country Parties, to enable them to implement the provisions of the Convention."

BACKGROUND

UNFCCC - 186 countries - mitigation of climate change

Kyoto Protocol to the Convention in 1997:

- **Reduction in GHG emissions in 38 developed countries and economies in transition**
- **Flexible Mechanisms:**
  - **Emission Trading**
  - **Clean Development Mechanism**
  - **Joint Implementation**

OBJECTIVES

- showing particular case of small island
- showing potentials of assumed rules of CDM on investing into clean energy technology in Developing Countries

CONTENTS

- Small island special case: Santo Antão, Cape Verde
- 4 scenarios of electricity production: potential CDM influence on investment viability of RET
- Influence of declining prices of RET
- On methodology of obtaining potential of RET - GIS
- Conclusions

SMALL ISLANDS SPECIAL CASE

- High price of small scale fossil fuel technology (diesel)
- Possible competitivness of renewable energy

Cape Verde

- Wind as competitive energy source in electricity production (8% of total)
- High dependency on diesel in electricity production

CASE: SANTO ANTÃO

Electricity production - island of Santo Antão
Case for CDM

2000-2030

Scenario 1: Business as usual* – Diesel only
Scenario 2: 30% RE - 25% Wind + 5% PV
Scenario 3: 30% Wind energy
Scenario 4: as scenario 2 with declining prices of RET

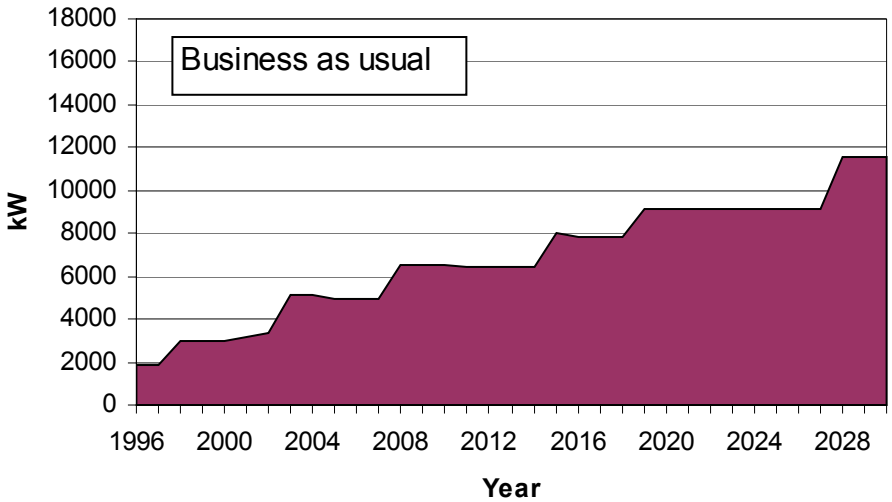
* based on studies by Jansénio Delgado et al.: Perspectivas de desenvolvimento, Plano director de electricidade de Santo Antão, 1997, Cape Verde, and Diagnóstico de situação local, Plano director de electricidade de Santo Antão, 1997, Cape Verde

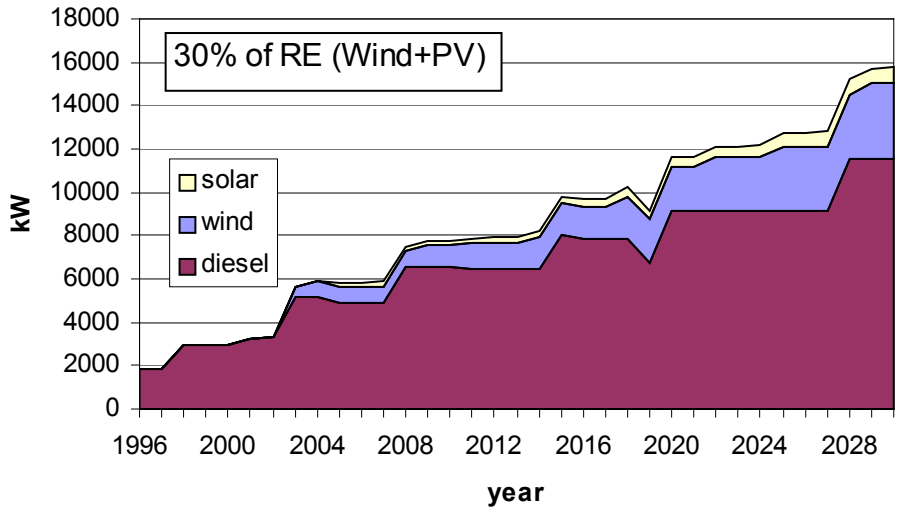
CASE: SANTO ANTÃO

The island of Santo Antão, Cape Verde

Santo Antão	scenario	1996	2010	2030
Electricity penetration		29%	70%	90%
Production [GWh]		2.6	14	50
Load peak [MW]		0.7	2.6	7.5
Installed capacity [MW]	BAU	1.9 D	6.5 D	11.5 D
	25% Wind + 5% PV		6.5 D +1 W +0.2 PV	6.5 D +3.5 W +0.8 PV
	30% Wind		6.5 D +1.3 W	11.5 D +4 W

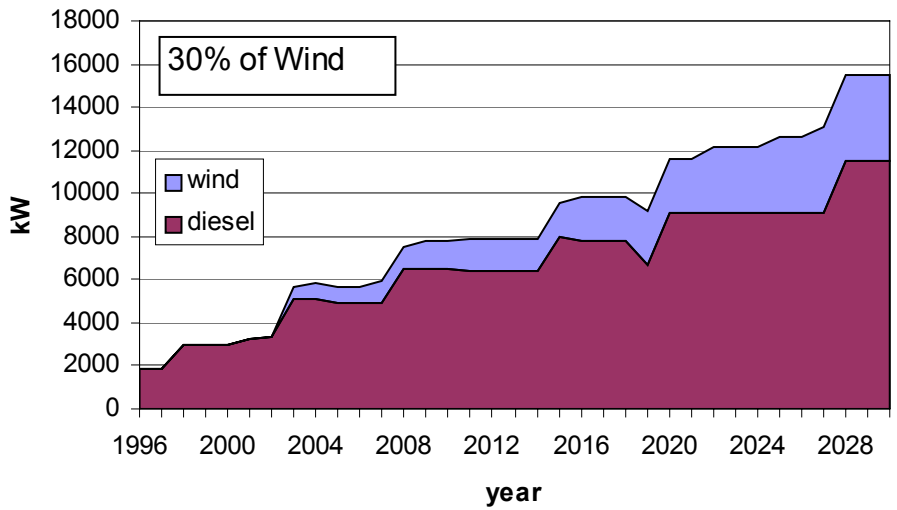
CASE: SANTO ANTÃO



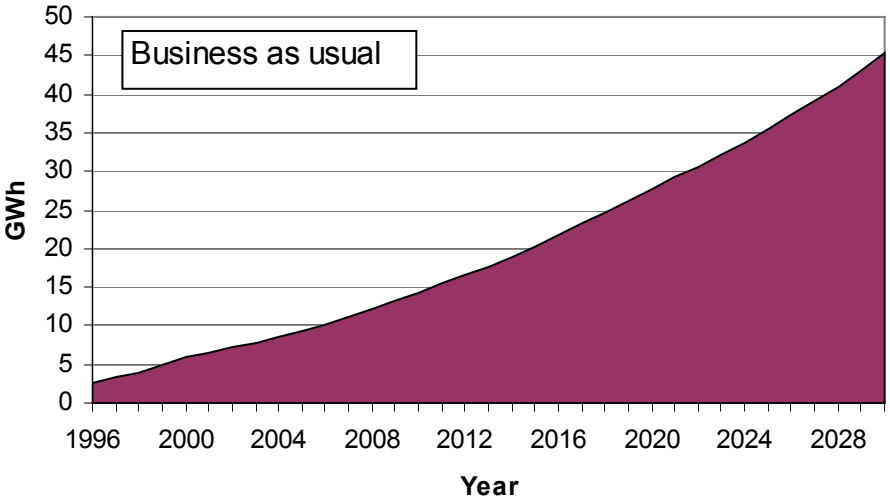


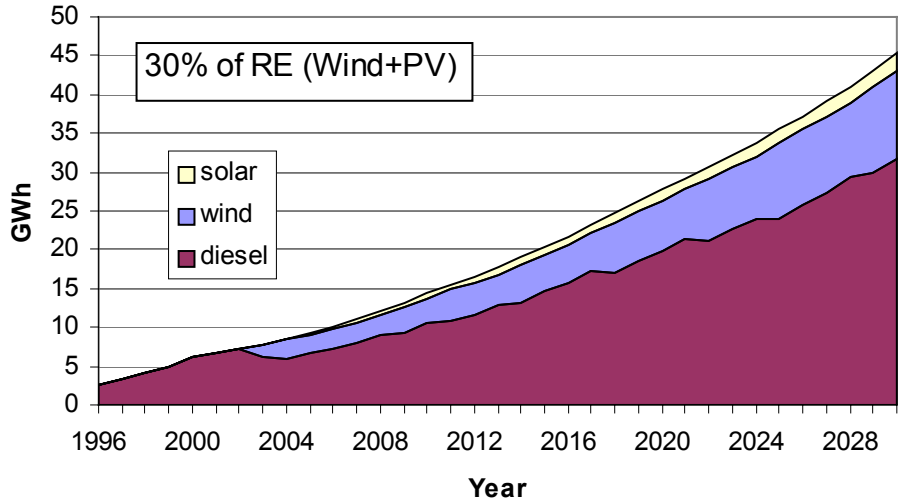
Installed capacities

- Wind does not reduce significantly the installed diesel capacity needed



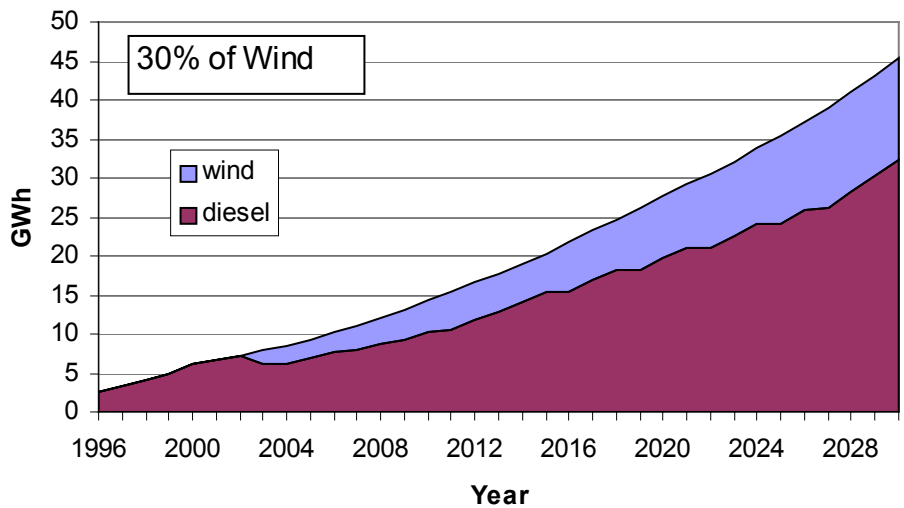
CASE: SANTO ANTÃO



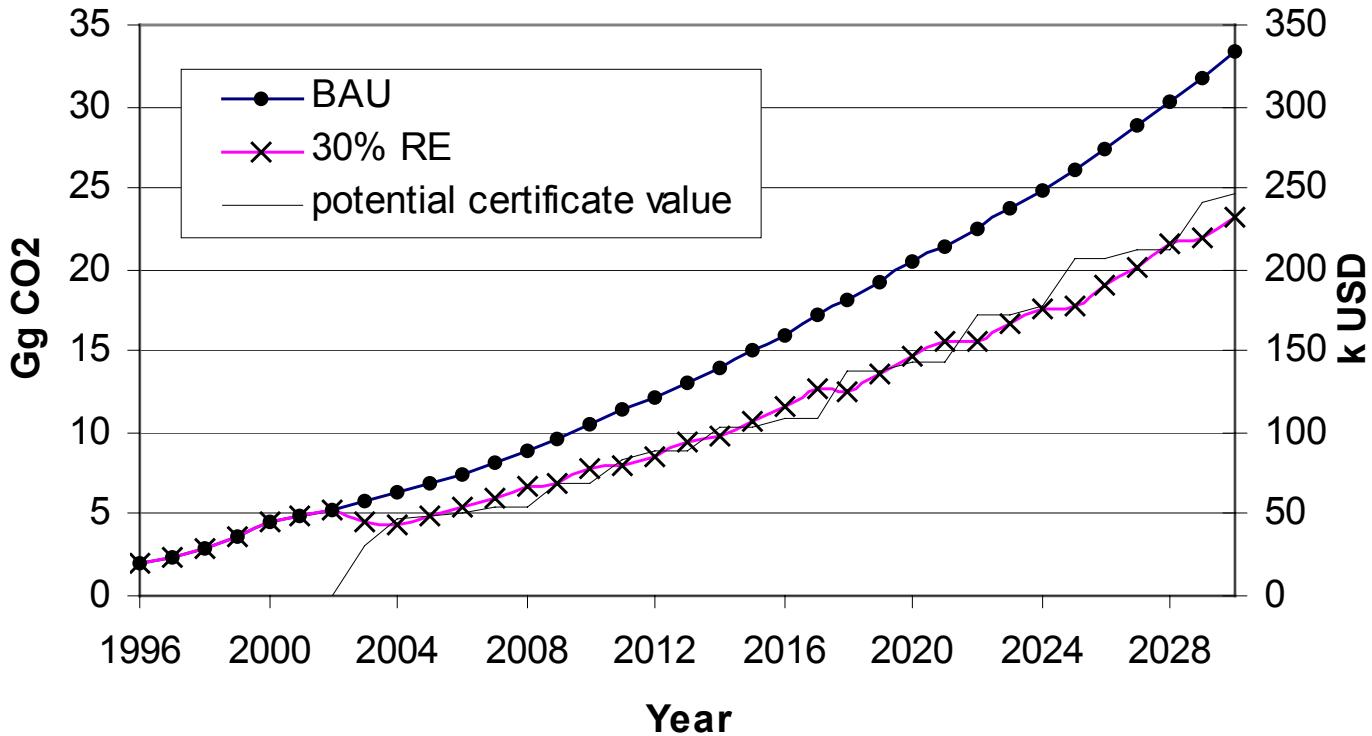


Electricity production

- Wind & PV - intermittent sources
- Diesel - the rest



CASE: SANTO ANTÃO



CO_2 emissions comparison and potential CDM value

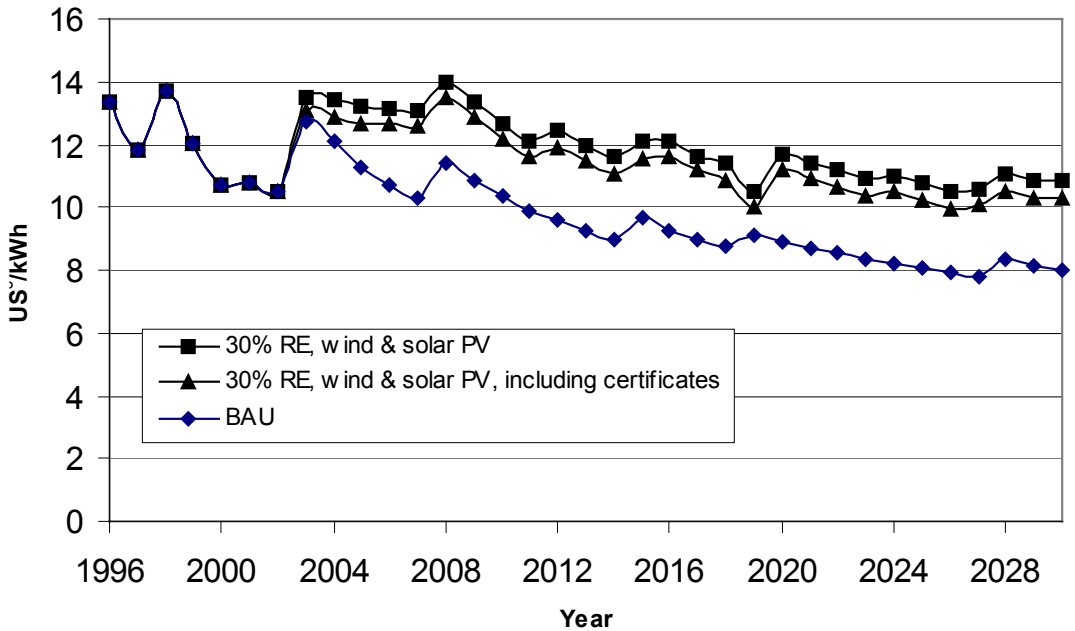
(based on OECD study that concluded that in case of emission trading the price of CO_2 reduction is 25 USD/tCO_2)

CASE: SANTO ANTÃO

Electricity cost

- **Diesel (at 45% load)** — **8 USD¢/kWh**
- **Wind** — **7 USD¢/kWh**
- **Solar PV** — **50 USD¢/kWh**

CASE: SANTO ANTÃO

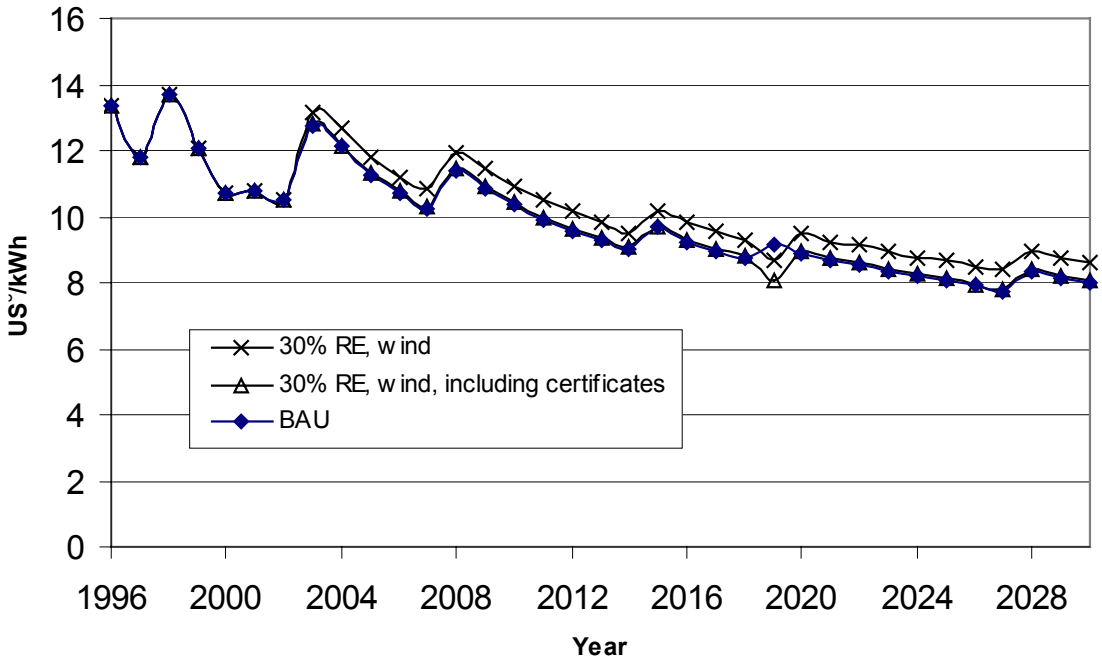


- Santo Antão - wind + PV scenario is not viable with current costs
- CDM does not help much this scenario
- constant prices of RET

Comparison of average electricity production price (1999 USD)

Scenarios 1-2: Business as usual and 30% RE, wind & solar PV

CASE: SANTO ANTÃO

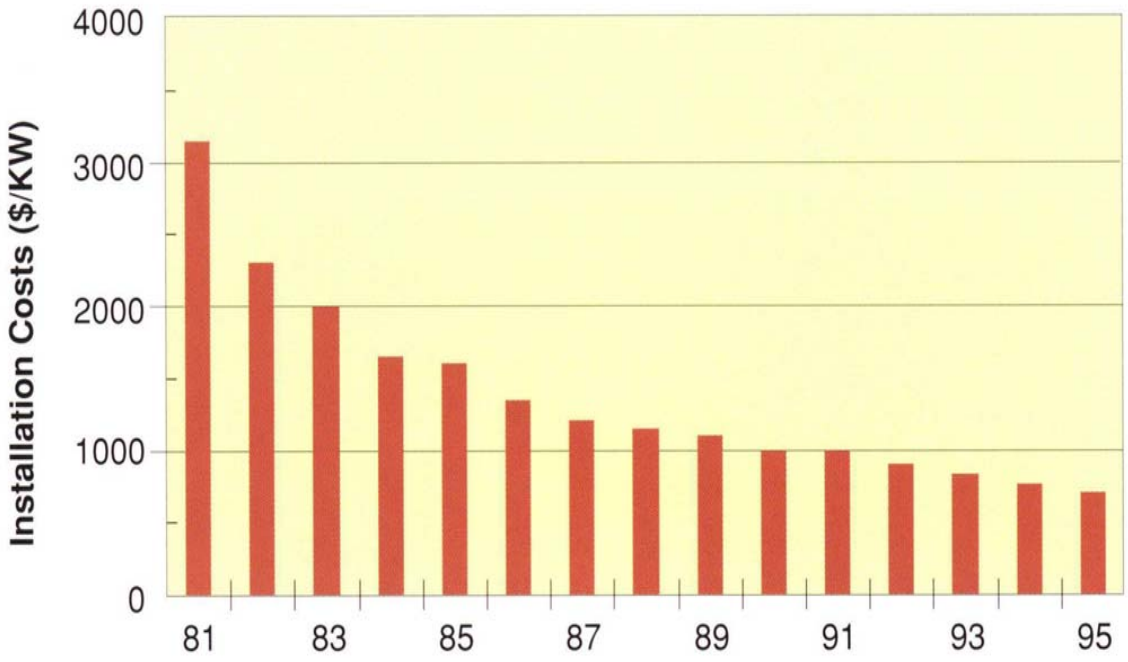


- Santo Antão - wind scenario is not viable with current costs
- CDM could help to make it viable
- constant prices of RET

Comparison of average electricity production price (1999 USD)

Scenarios 1 and 3: Business as usual and 30% wind

CASE: SANTO ANTÃO

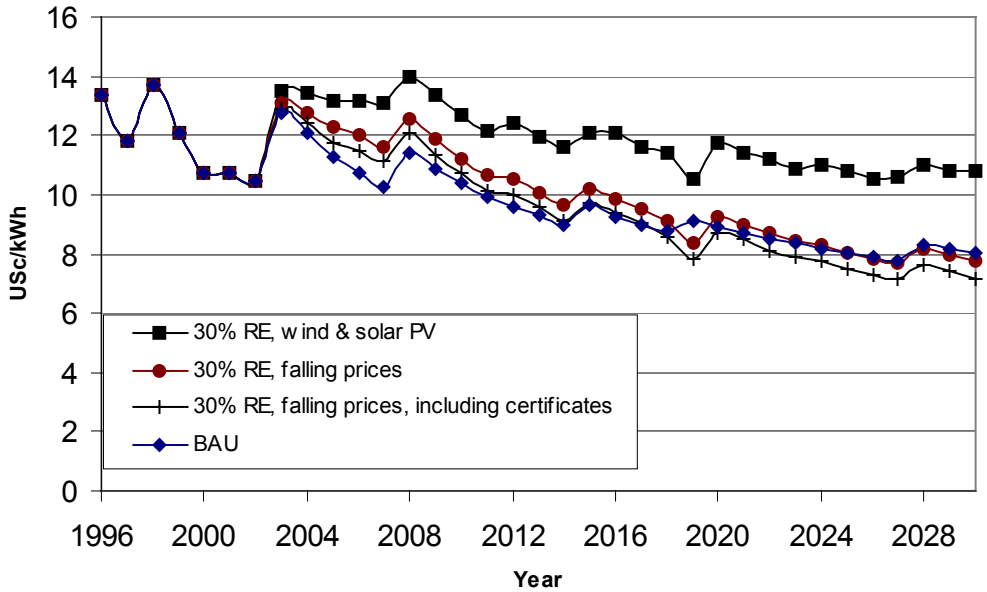


- Most calculations of RET viability assume static relations between different technologies implied costs
- RET are extremely dynamic technologies costwise

Innovation brings fall in cost of RET

ABB: Renewable Energy, Status and Prospects, 1998

CASE: SANTO ANTÃO



- Scenarios 1, 2 and 4 - Influence of RET innovation
- Credibility of BAU as CDM baseline depends on declining prices

- Santo Antão - wind & PV scenario gets viable with falling prices
- CDM helps it to become viable sooner
- falling prices of RET - 2% yearly price decline for wind and 5% price decline for PV

INTEGRATION

In order to integrate the investment decision process IST also work on technical viability - GIS

- digitalised geographic + demographic + economic data
- wind potential - GIS + WASP
- solar potential - SOLARGIS
- location viability - GIS + potential

CONCLUSIONS

- CDM could help reduce CO_2 emissions from electricity production by one third from baseline
- CDM could help viability of investing in clean technologies in Developing Countries, even small
- Even better for big DCs - increasing supply side efficiency - bigger GHG reduction potential
- Contribution to the host country´s sustainable development needs