



TITLE

Facilitating the Kyoto Protocol Objectives by Clean Development Mechanism in Small Island Developing States – CDMSIDS Project

The potential for Clean Development Mechanism in electricity production

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OBJECTIVES



- **To show the potential for CDM in electricity generation sector in Cape Verde**
- **To show the potential for clean technologies transfer to Cape Verde due to CDM**

CONTENT



- **Introduction**
- **Population scenarium description**
- **Economic scenaria – 3 scenaria**
- **Electricity demand scenarium**
- **Electrification scenaria**
- **Electricity supply scenaria – 3 scenaria**
- **Clean Development Mechanism scenaria – 3 scenaria**
- **Conclusions**

INTRODUCTION



INTRODUCTION



- Each islands naturally a separate power system
- The need to model each island separately
- The problems with connecting islands by power cables – not envisaged by this study
- Electrification
- Connection of independent grids on each island

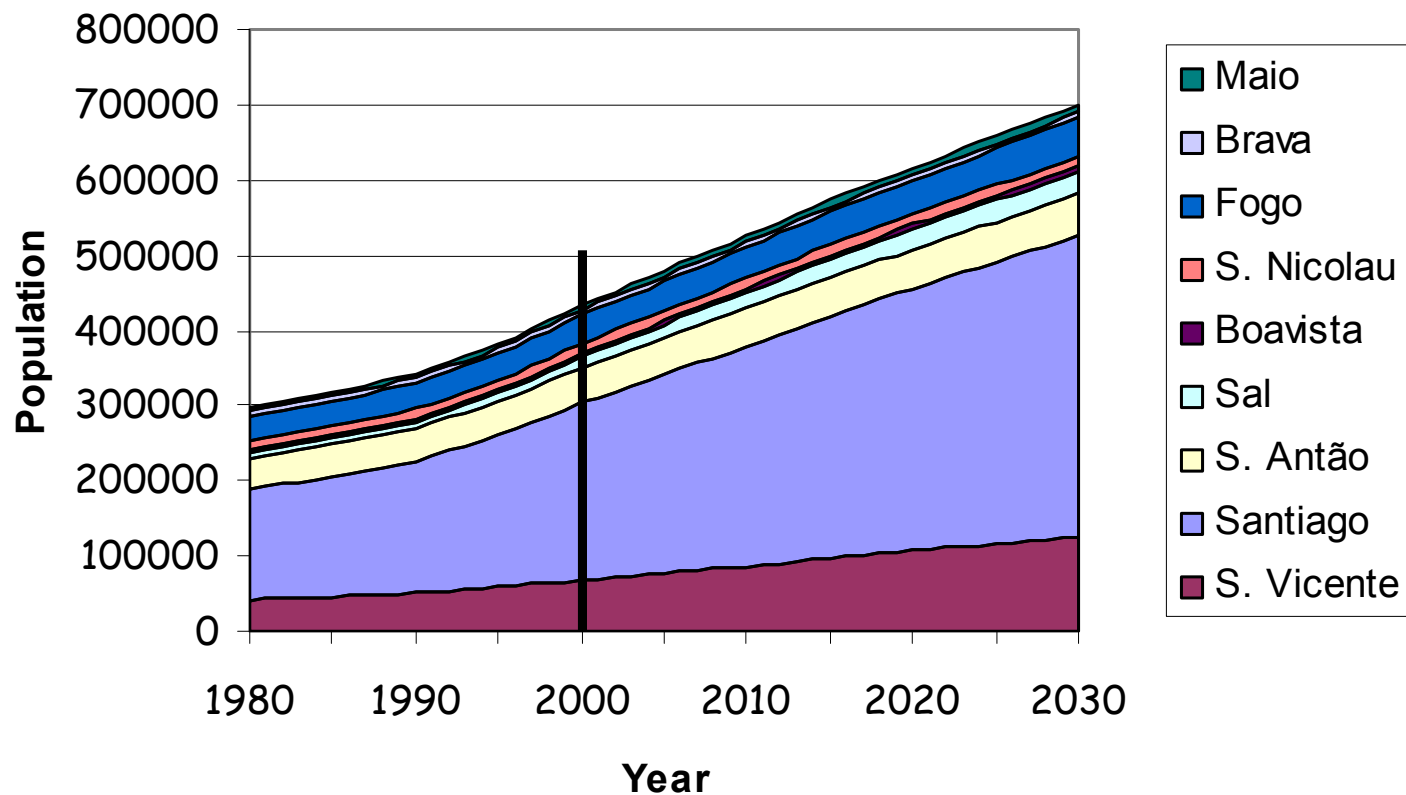
INTRODUCTION



For each island 27 scenaria:

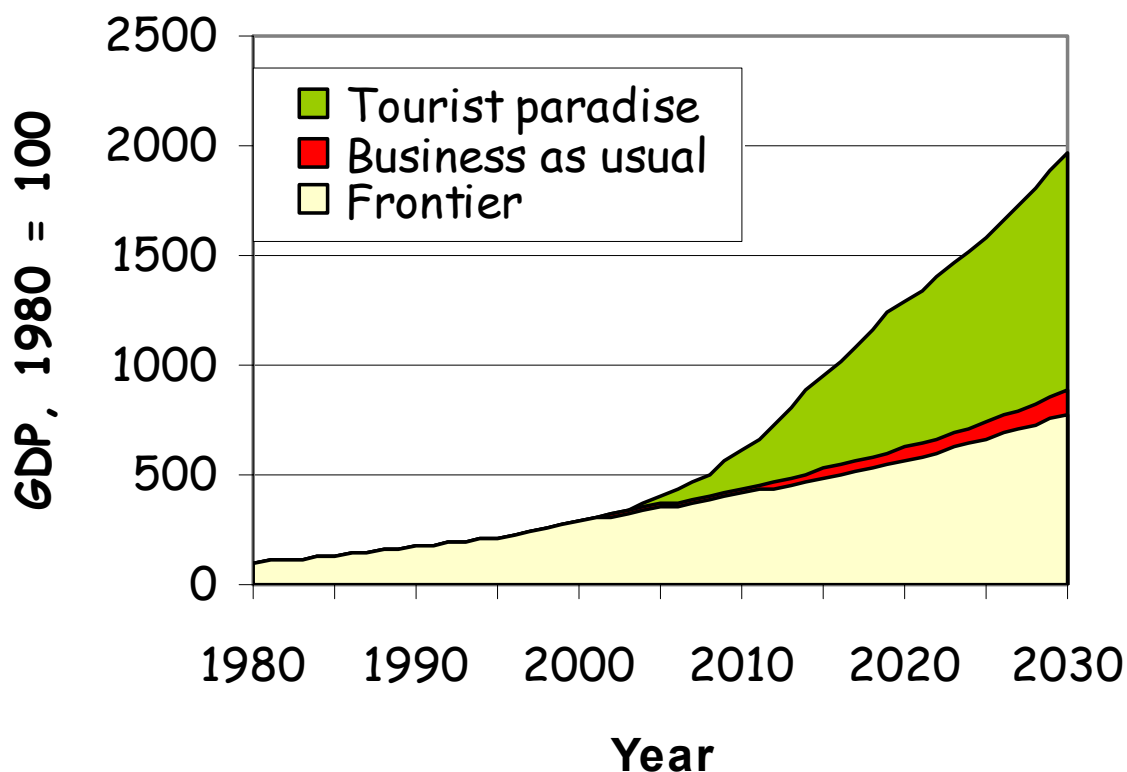
- **Demographic scenarium 2000-2030**
- **3 Economic scenaria 2000-2030**
 - **Business as usual**
 - **Cape Verde as tourist paradise**
 - **Cape Verde still as frontier**
- **Electricity demand scenaria 2000-2030 (one for each economic scenarium)**
- **3 Electricity supply scenaria 2000-2030 for each demand scenarium**
- **3 CDM scenaria 2000-2030 for each supply scenarium**

POPULATION



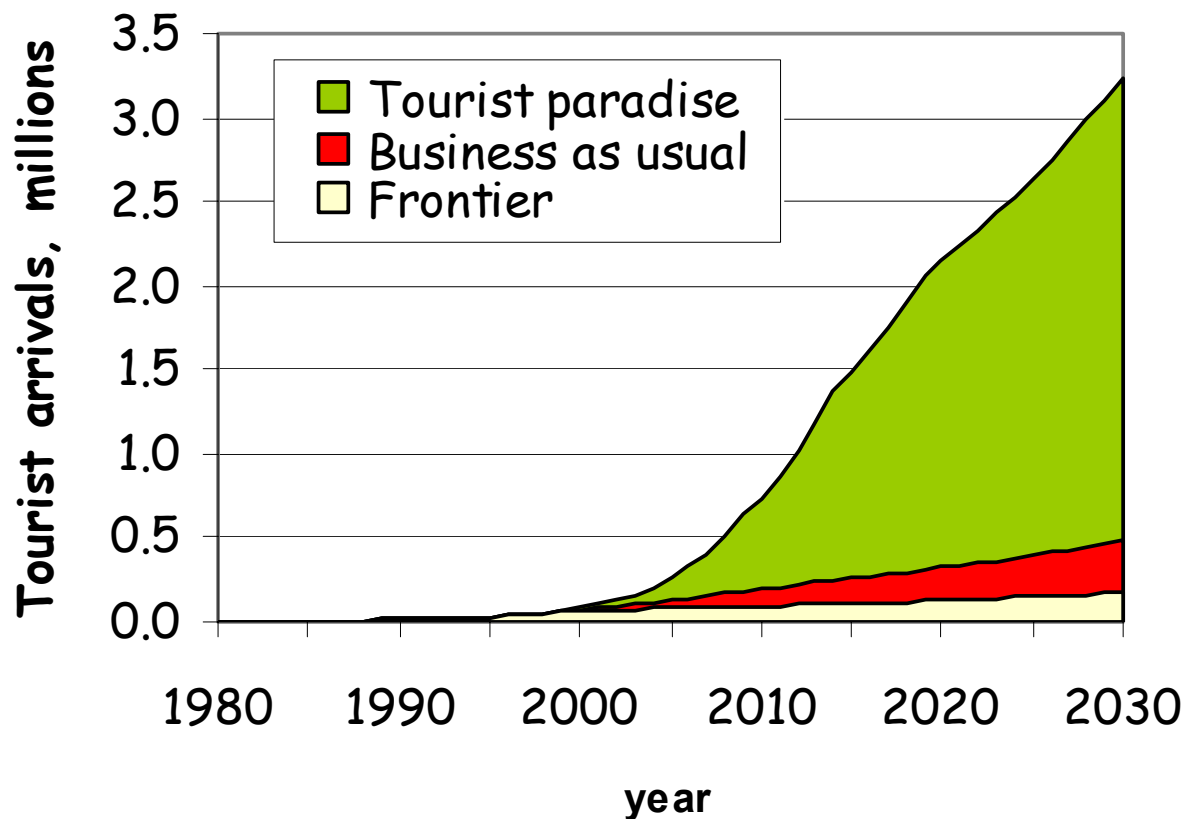
Growth centers:

- Santiago
- Sal
- Boavista
- São Vicente



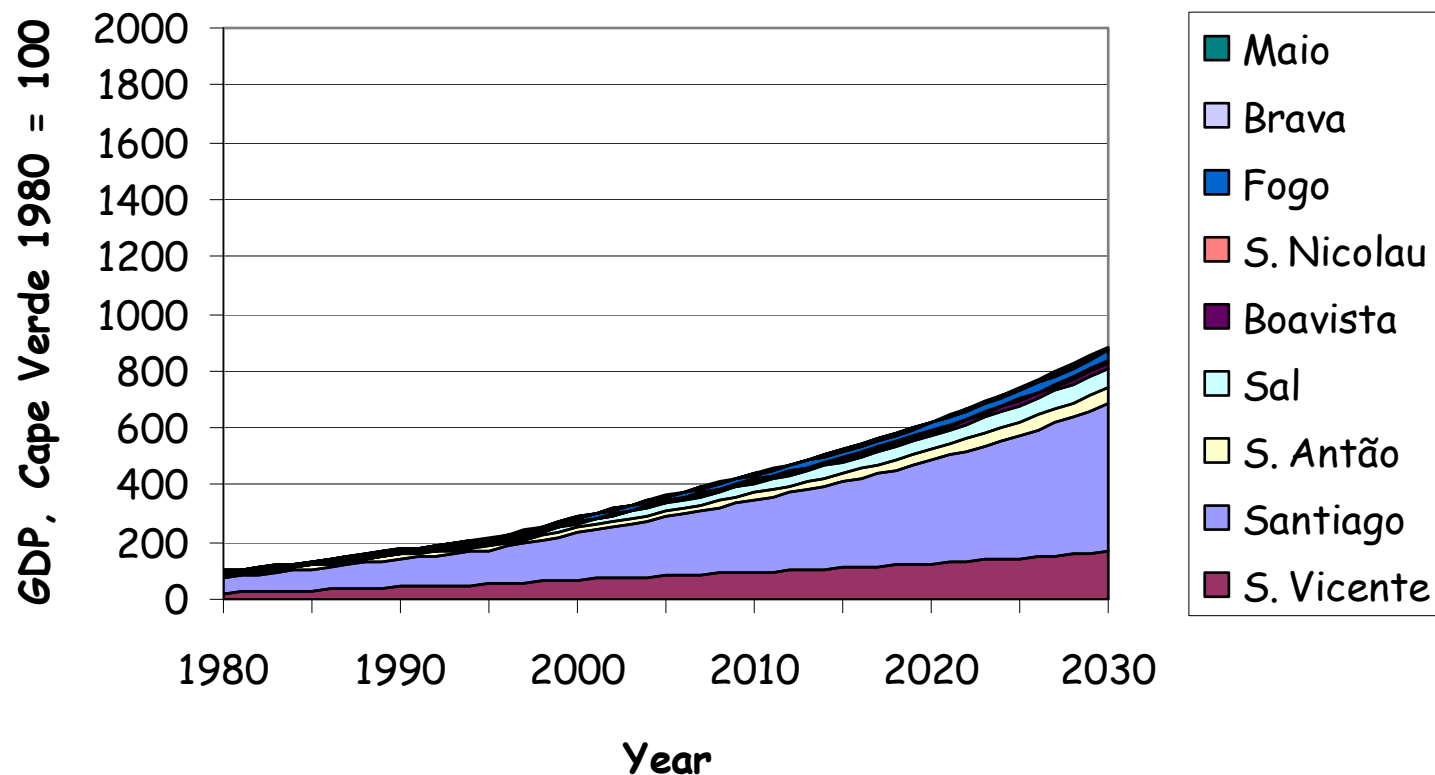
Three scenarios:

- **Business as usual**
- **Tourist paradise scenario**
- **Frontier scenario (no Praia airport, slow electrification, little infrastructure)**



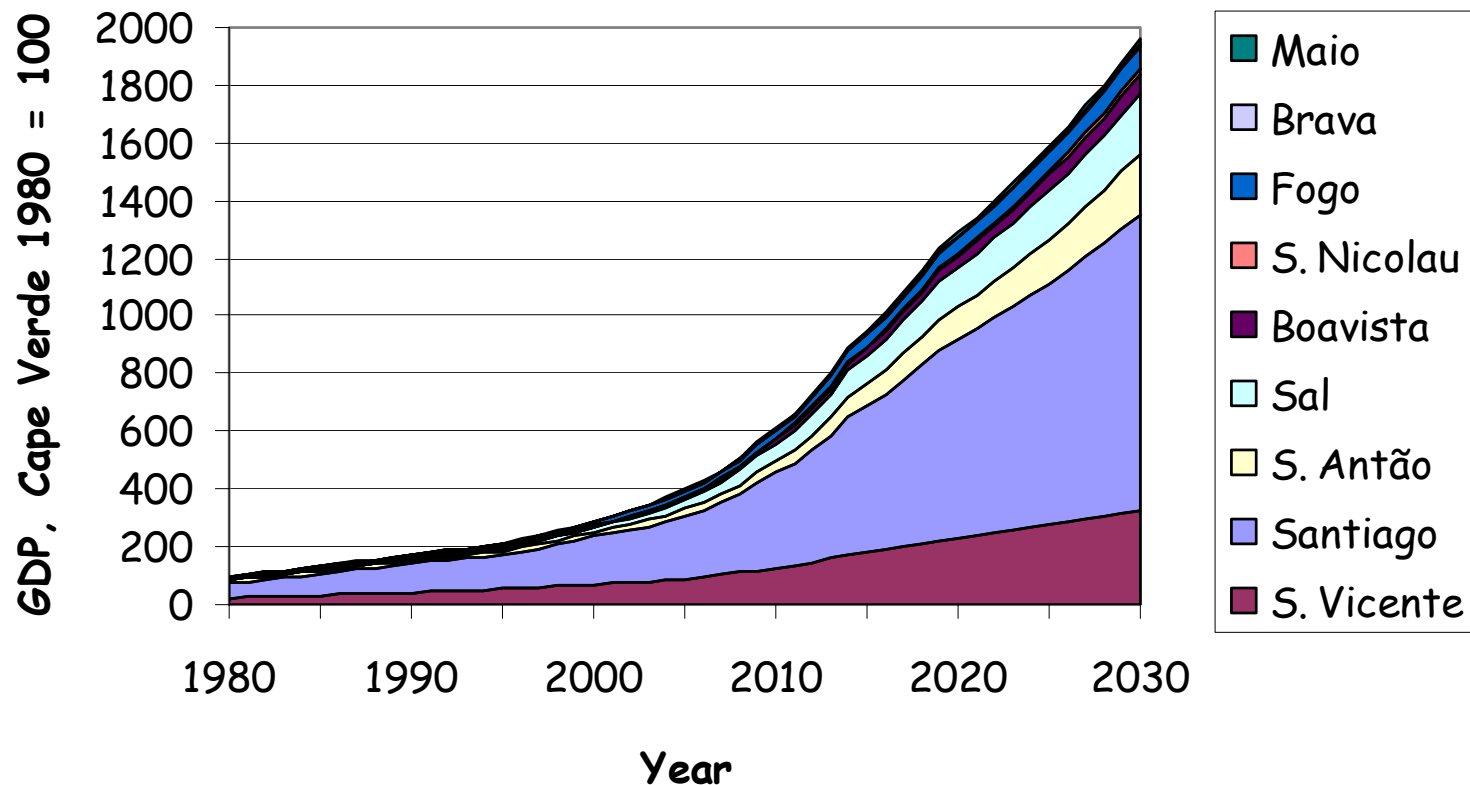
Tourist paradise

- Sal & Boavista intensive tourism
- Santo Antão, Santiago, São Vicente, Maio, importance of tourism
- Spill over effect in other sectors

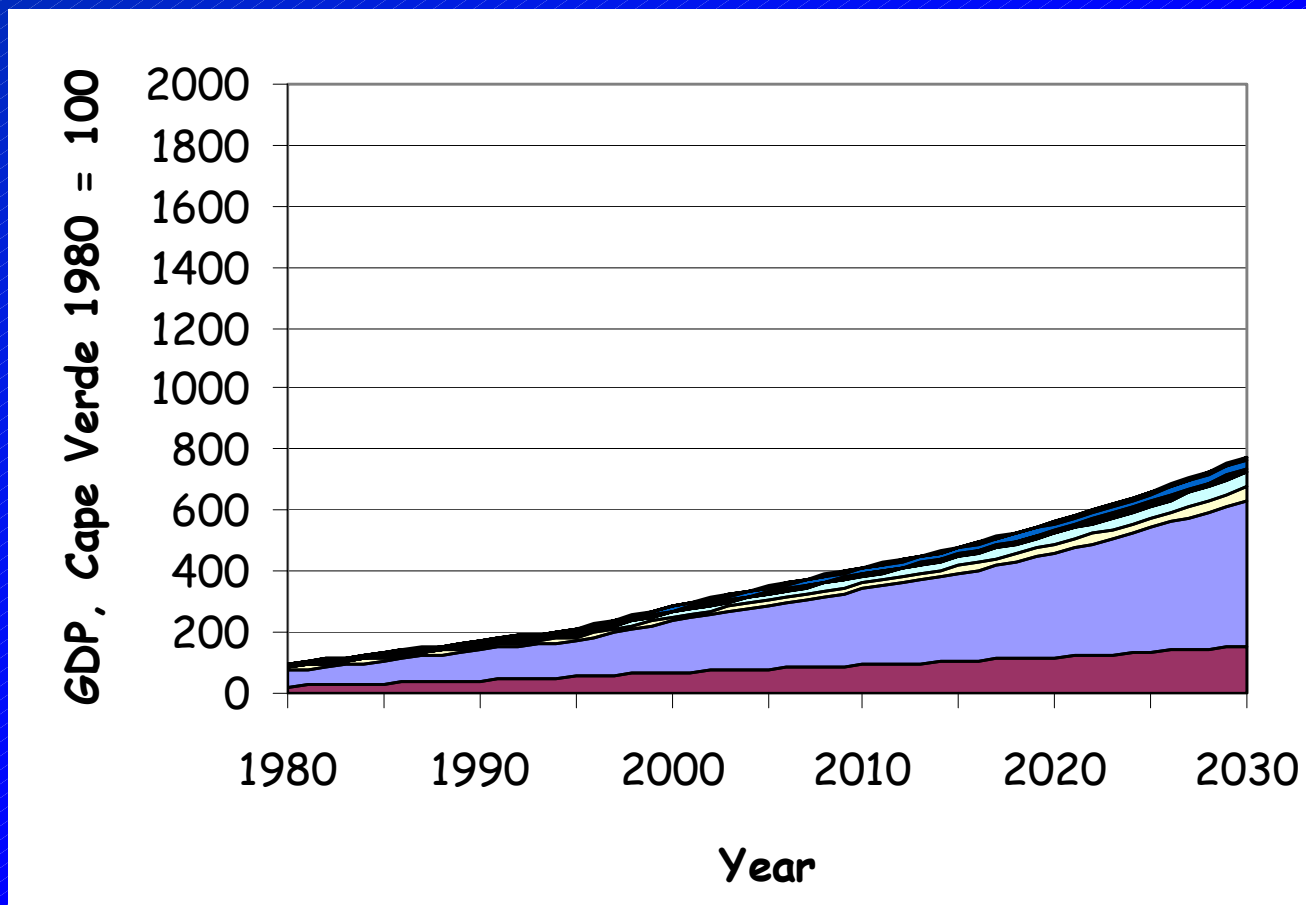


Business as usual scenarium, regional distribution of GDP

ECONOMY - PARADISE

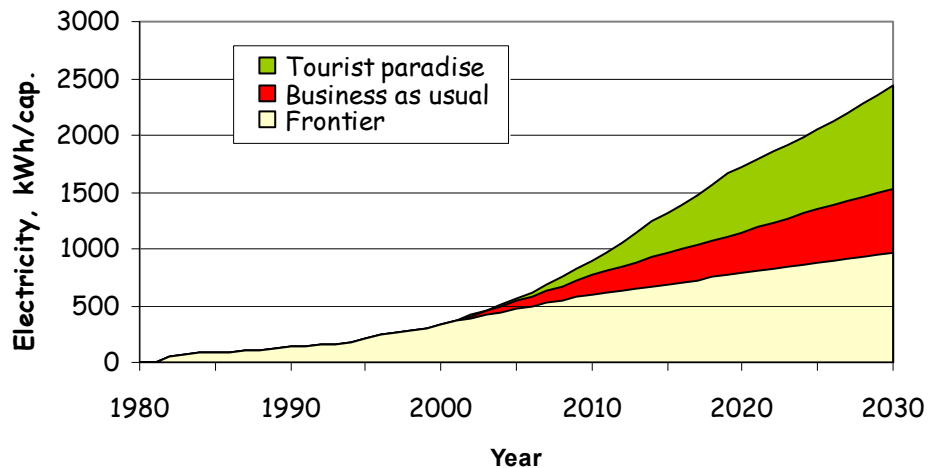
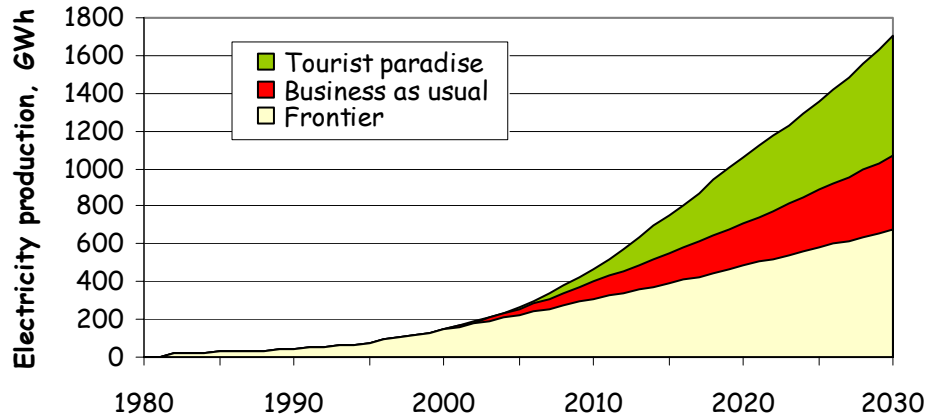


Tourist paradise scenarium, regional distribution of GDP



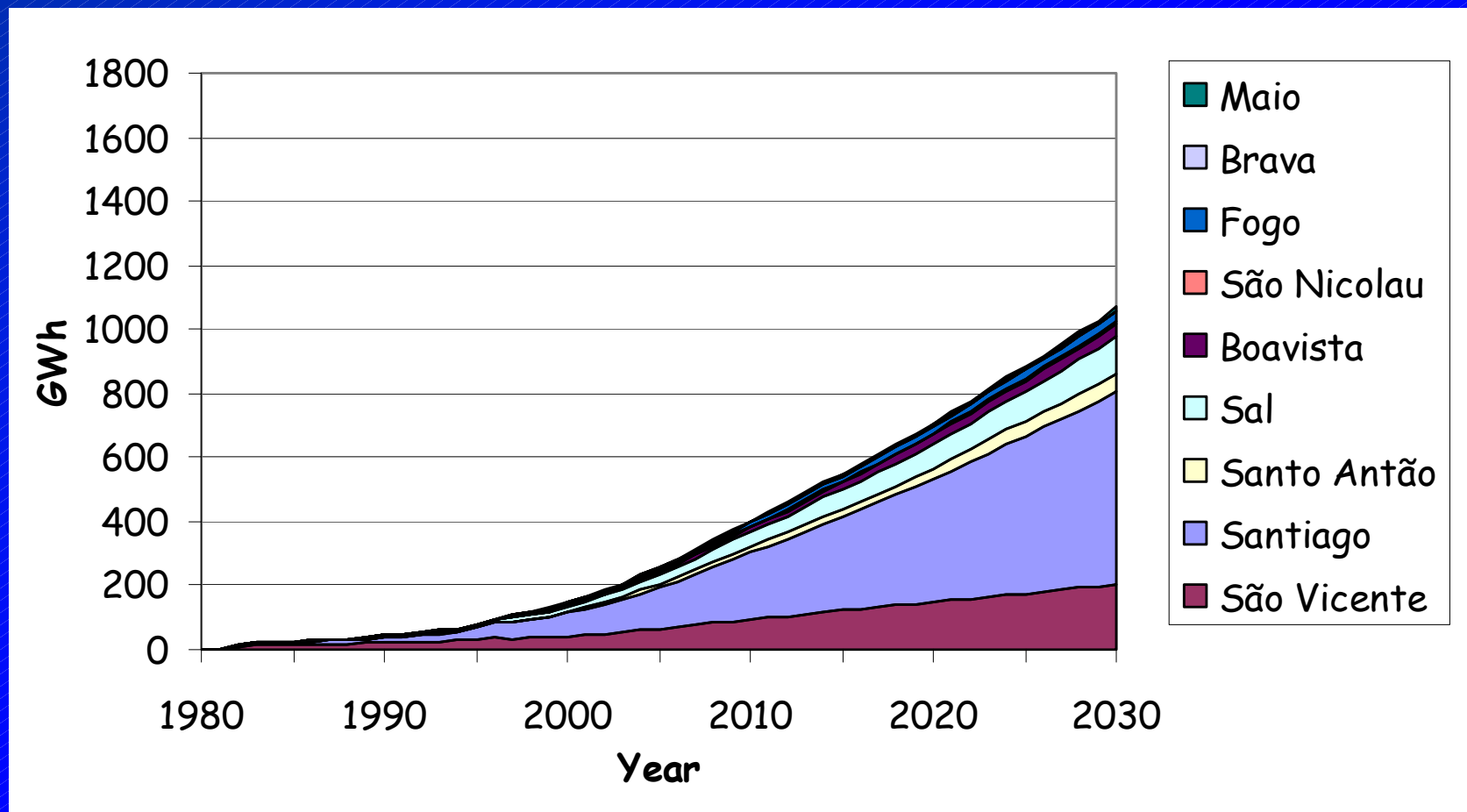
Frontier scenarium, regional distribution of GDP

ELECTRICITY DEMAND



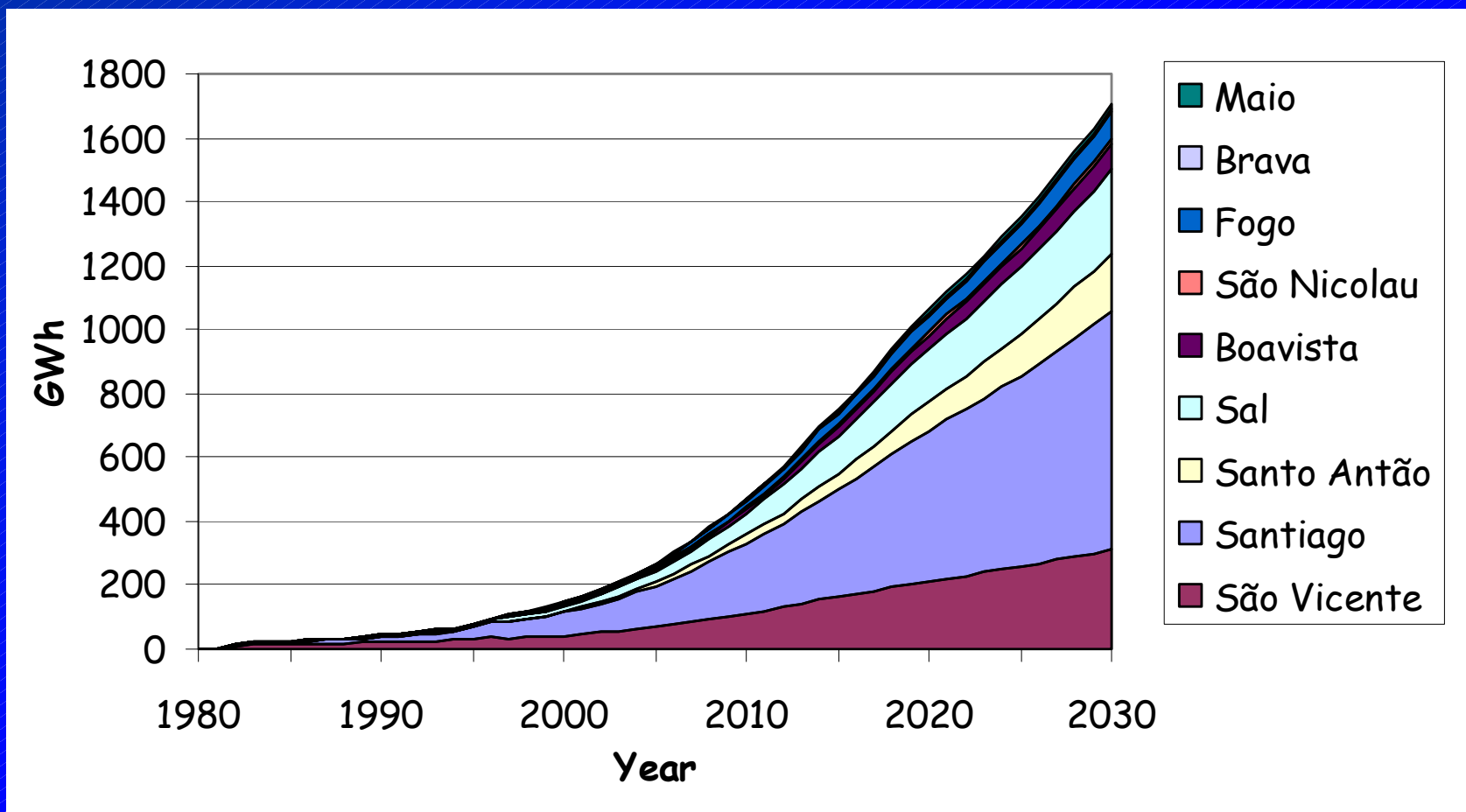
- Tourist sector
- Electrification rate
- Security of supply

ELECTRICITY DEMAND - BAU



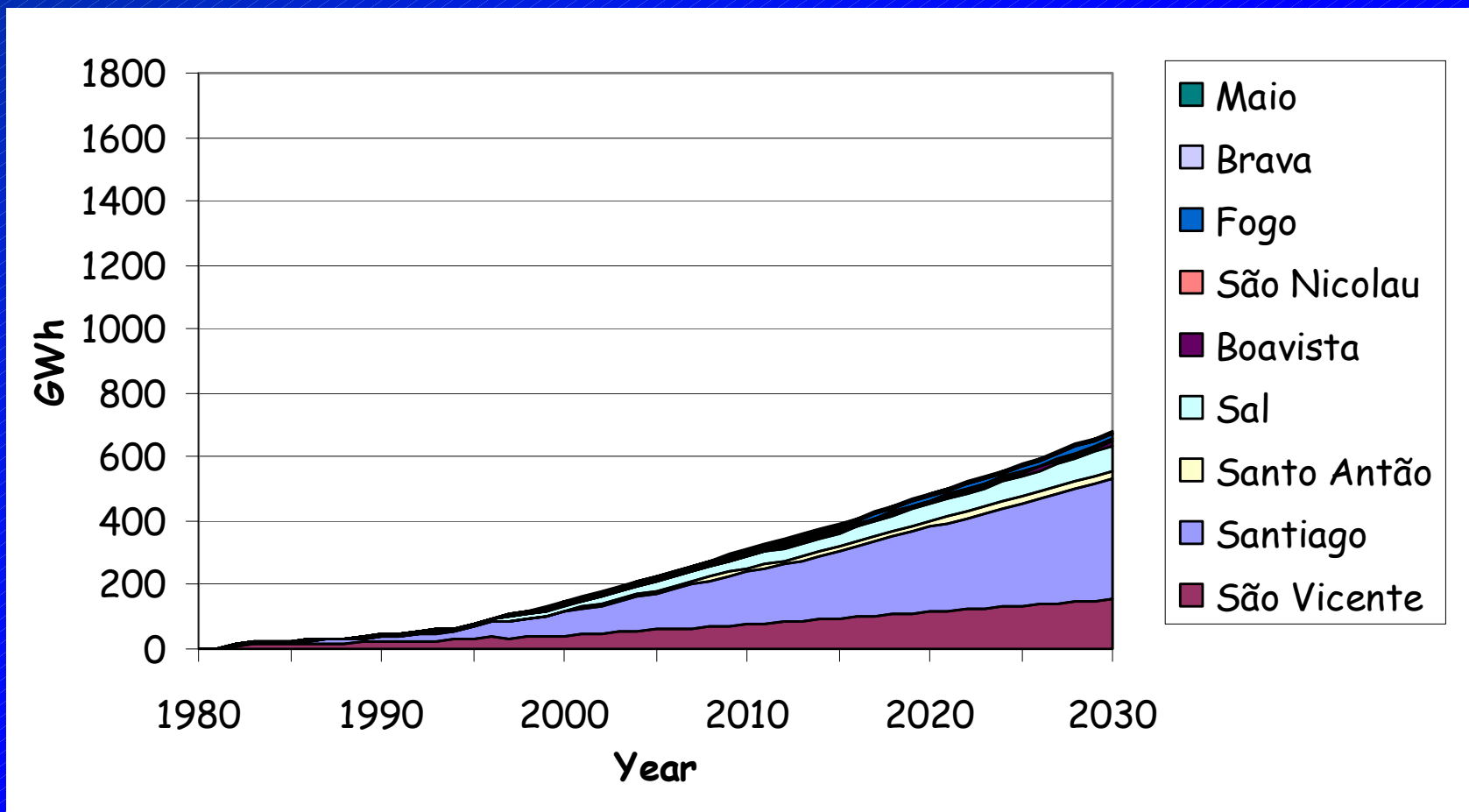
Business as usual scenarium, regional distribution of electricity demand

ELECTRICITY DEMAND - PARADISE



Tourist paradise scenarium, regional distribution of electricity demand

ELECTRICITY DEMAND - FRONTIER



Frontier scenarium, regional distribution of electricity demand

For each island and for each economic/electricity demand scenaria

Electricity supply scenaria:

- 1. Baseline – Diesel + wind installed and to be installed in 2002**
- 2. 30% wind electricity for all islands**
- 3. Combined cycle + 30% wind – scenario 2 + 10 MW CC base power units for systems where peak is > 35 MW**



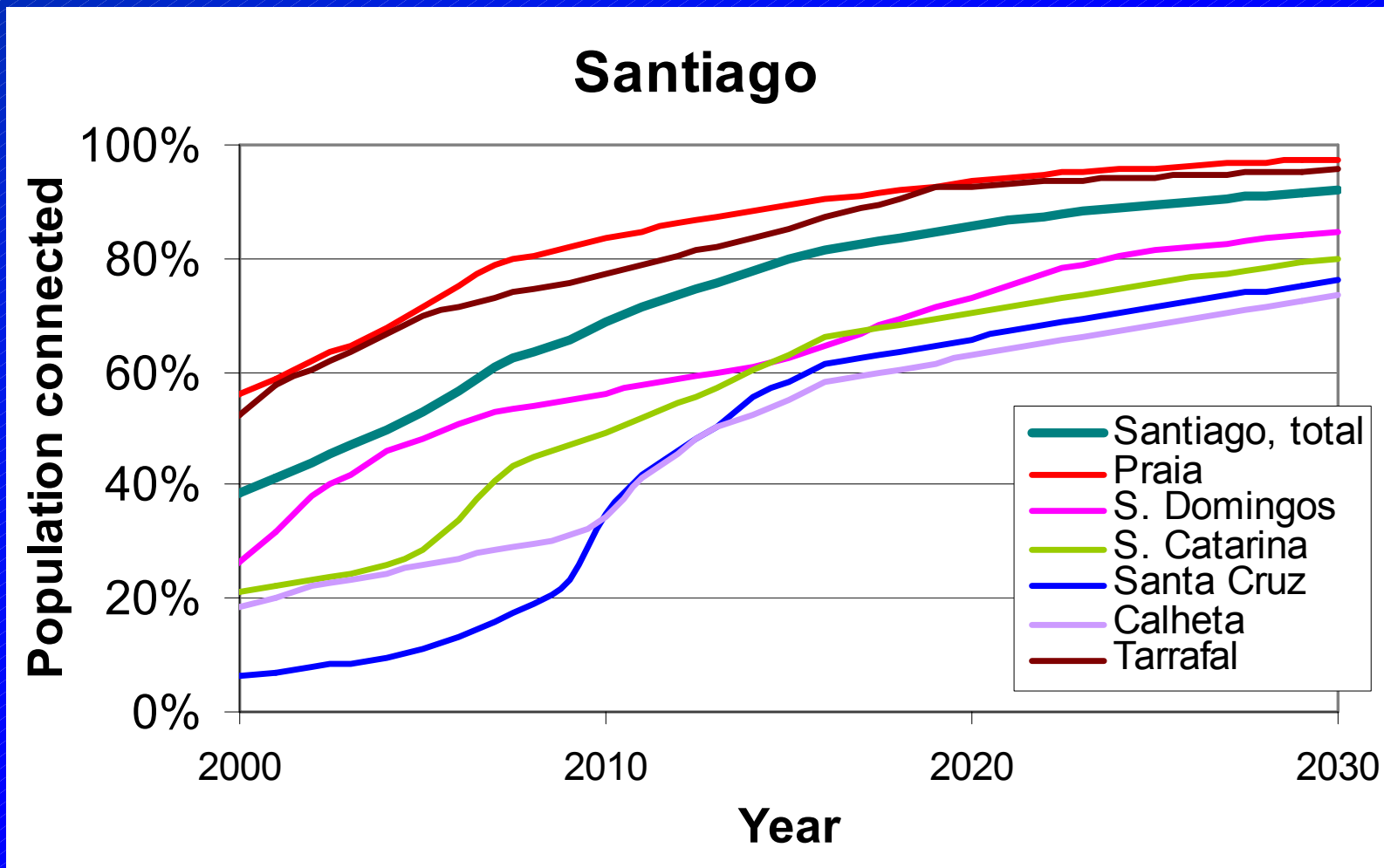
2001-2005

- Santiago – Santa Catarina and Santa Cruz linked to main network (Praia)
- Santo Antão – Porto Novo linked to main network (Ribeira Grande)
- São Nicolau – Tarrafal linked to main network (R. Brava)

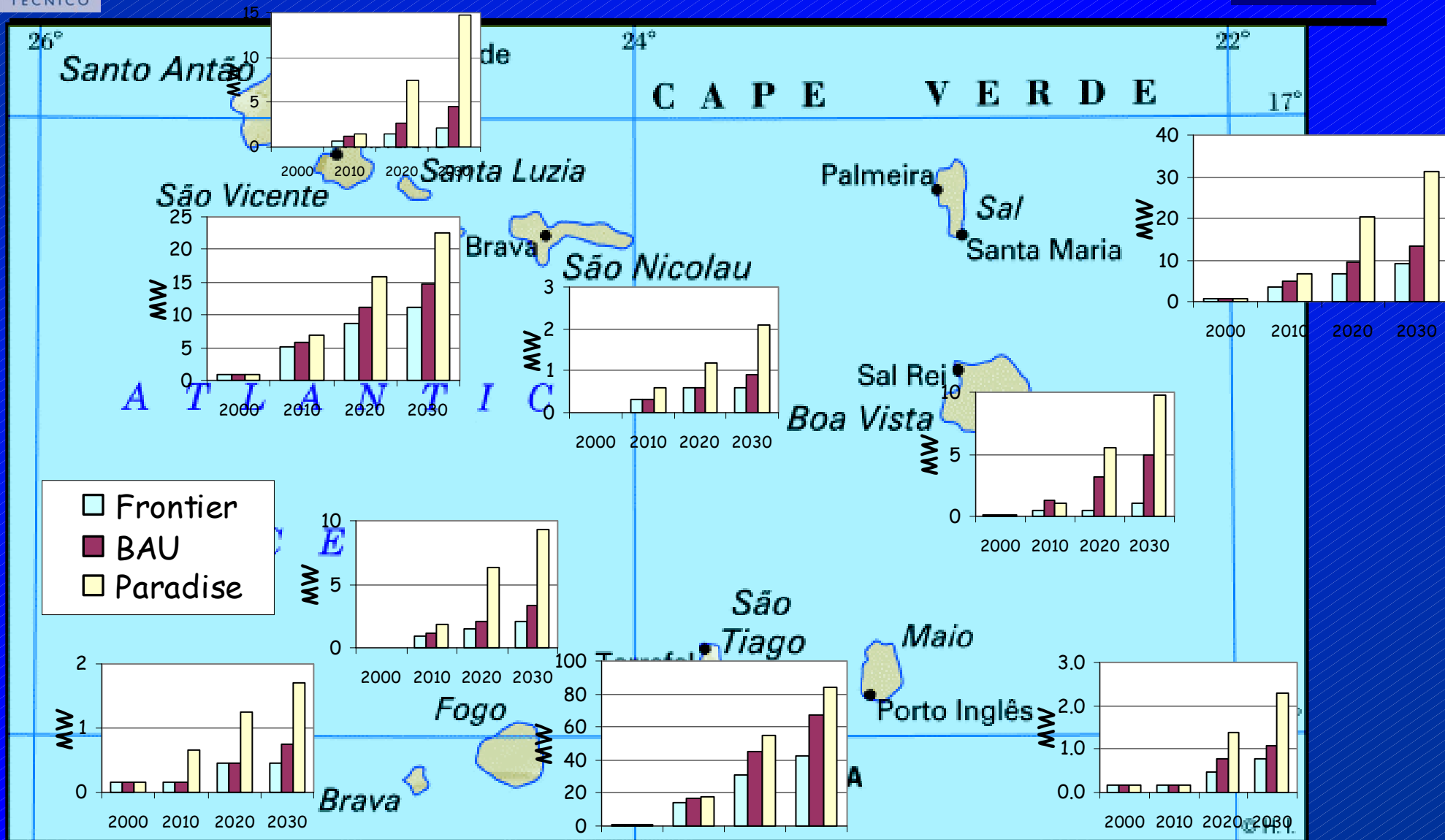
2006-2010

- Santiago – Calheta and Tarrafal linked to main network (Praia)
- Fogo – São Felipe linked to main network (Mosteiros)

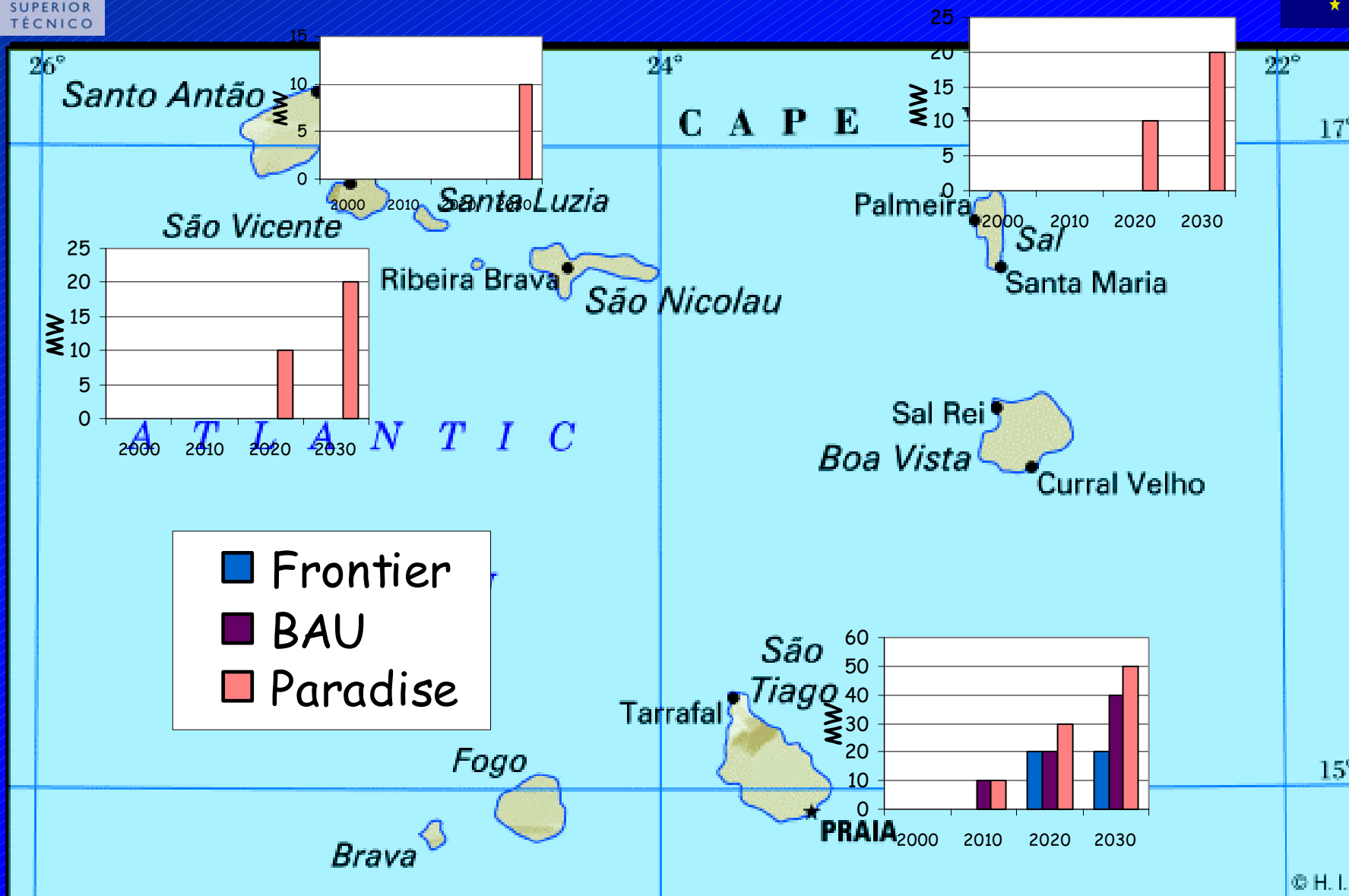
ELECTRIFICATION 2000-2030



WIND TURBINES INSTALLED



COMBINED CYCLE INSTALLED



Business as usual scenarium

2005 – 13500 kW wind turbines

- Santiago 12x600 kW + São Vicente 3x600 kW + Santo Antão 3x300 kW + Sal 3x600 kW + Boavista 2x300 kW + São Nicolau 300 kW + Fogo 3x300 kW

2008 – 10800 kW wind turbines

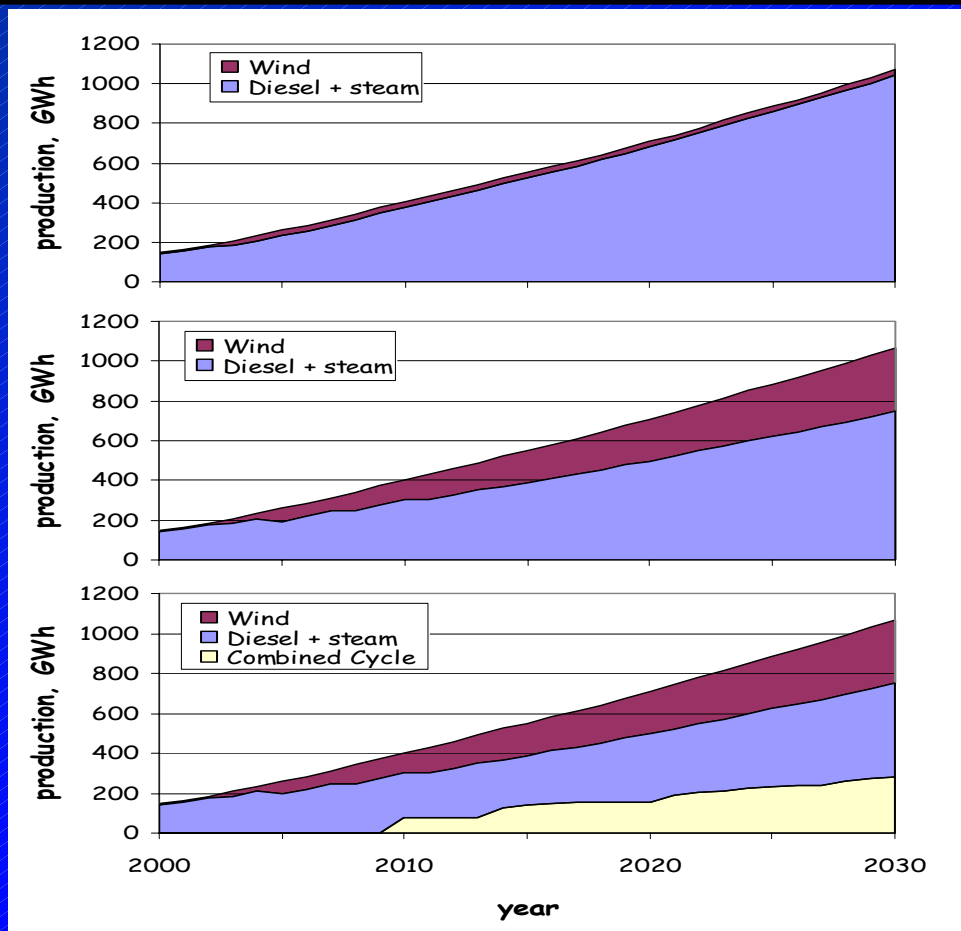
- Santiago 12x600 kW + São Vicente 2x600 kW + Santo Antão 300 kW + Sal 2x600 kW + Boavista 2x300 kW + Fogo 300 kW

2010 – 10000 kW Combined cycle, Santiago

2011 – 13800 kW wind turbines

- Santiago 15x600 kW + São Vicente 3x600 kW + Santo Antão 300 kW + Sal 2x600 kW + Boavista 2x300 kW + Fogo 300 kW + Brava 300 kW + Maio 300 kW

ELECTRICITY SUPPLY - BAU



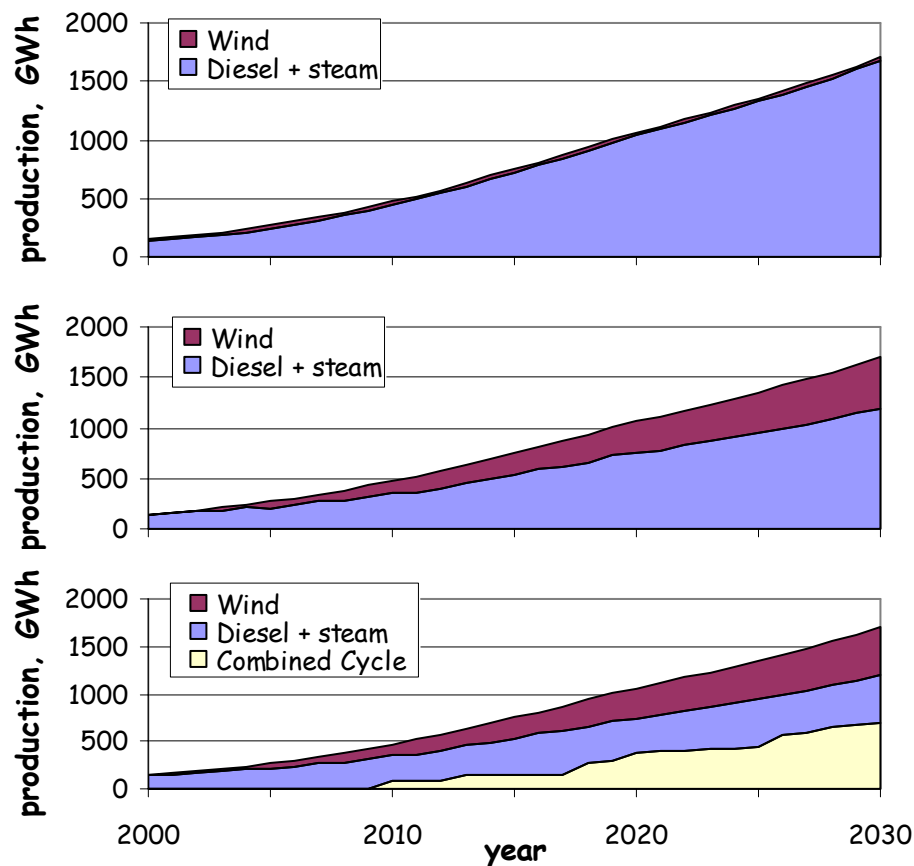
Baseline

30% wind

**Combined cycle
30% wind**

Business as usual economic scenarium

ELECTRICITY SUPPLY - PARADISE



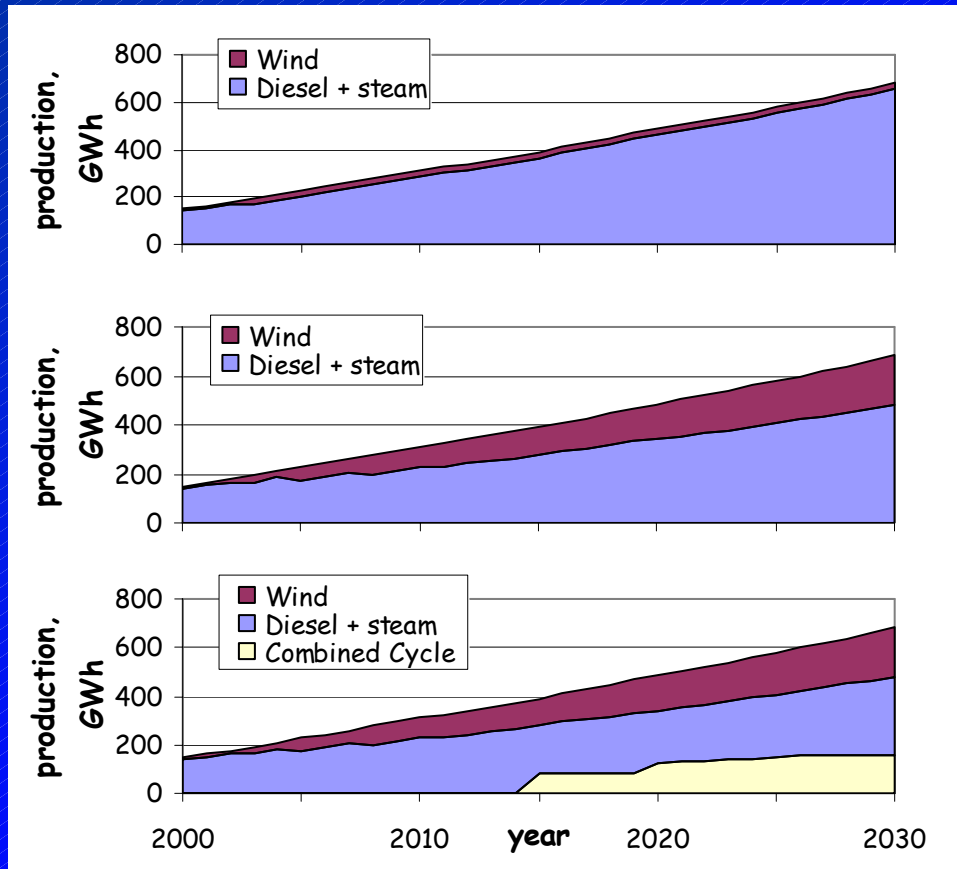
Baseline

30% wind

**Combined cycle
30% wind**

Tourist paradise economic scenarium

ELECTRICITY SUPPLY - FRONTIER



Baseline

30% wind

**Combined cycle
30% wind**

Frontier economic scenarium

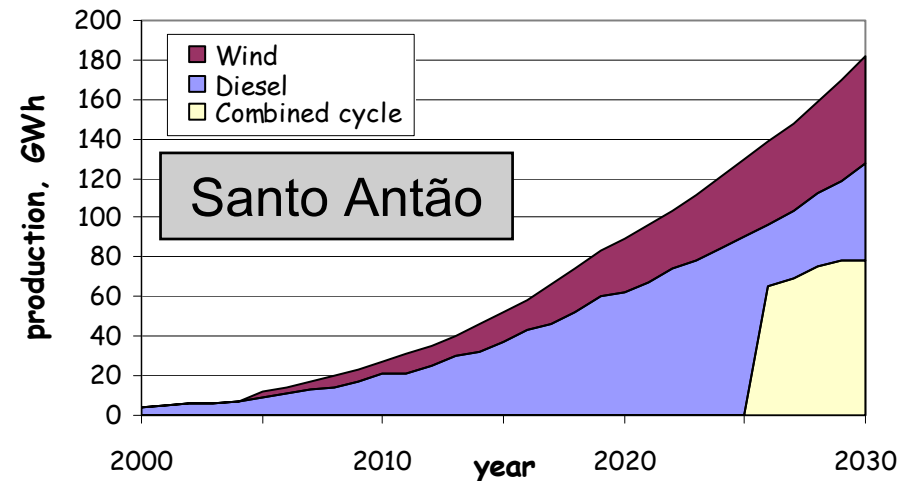
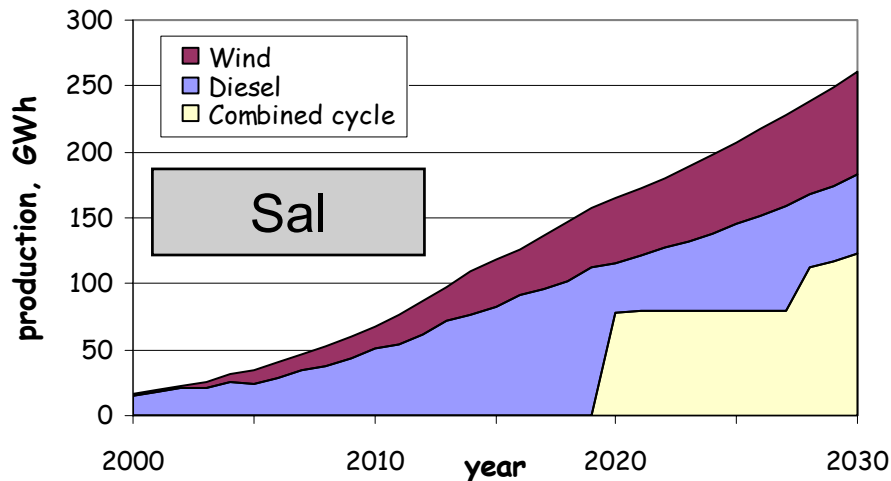
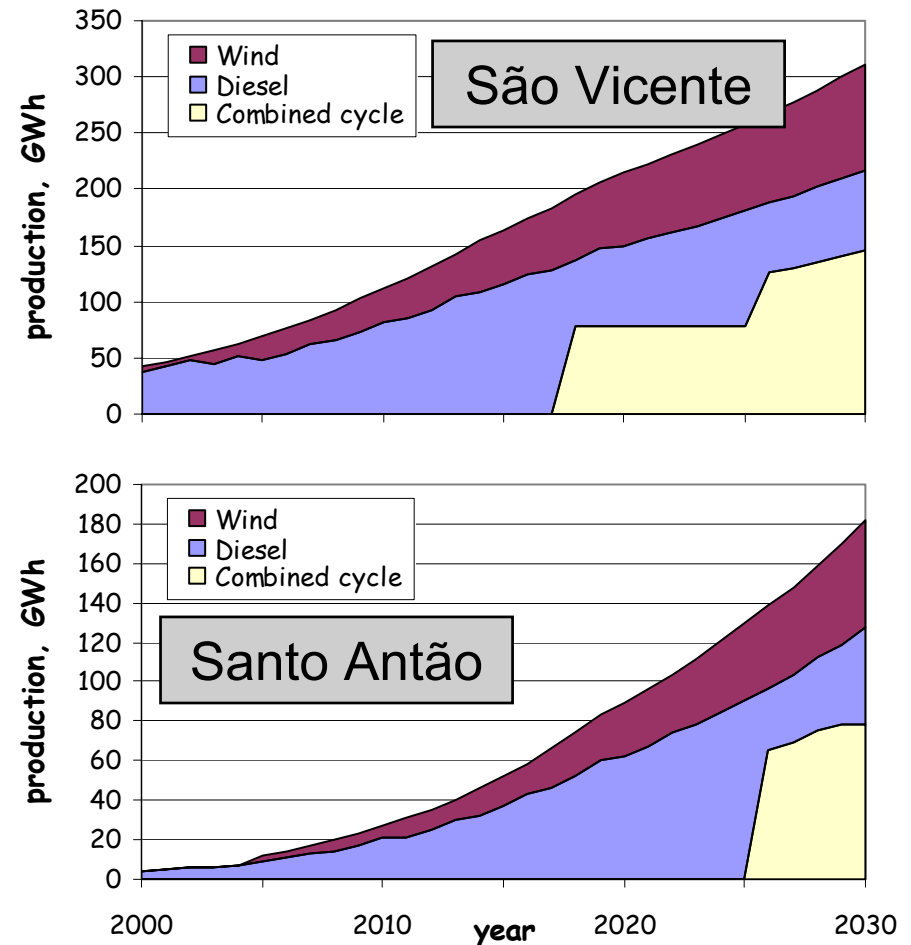
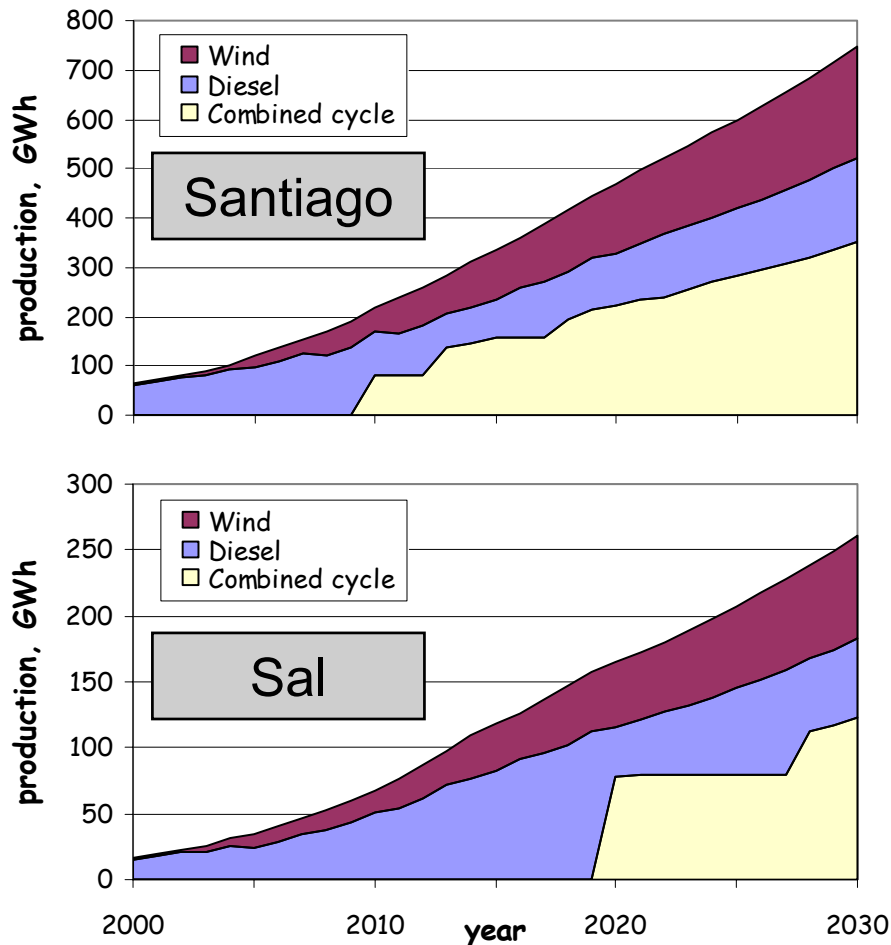
ELECTRICITY SUPPLY – REGIONAL



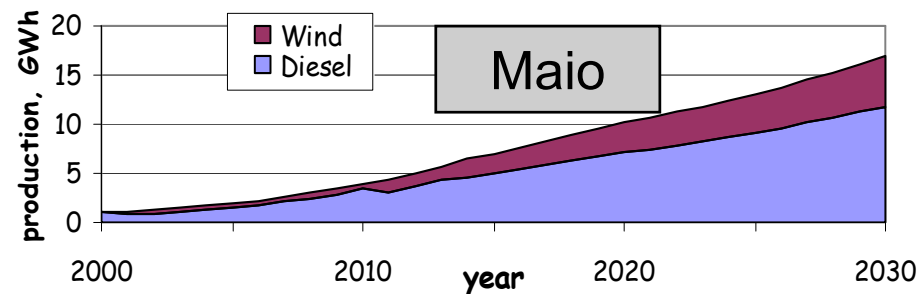
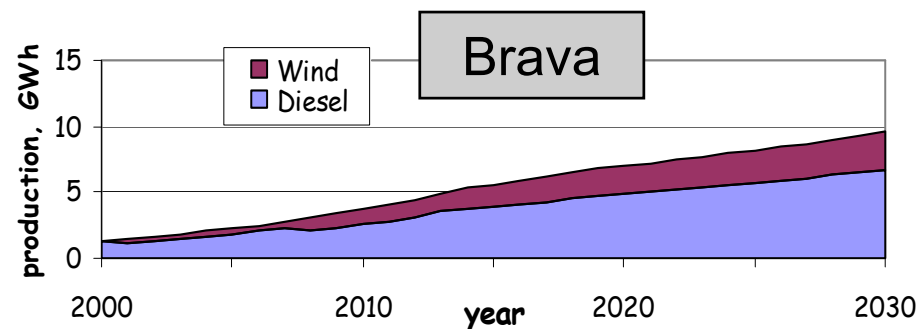
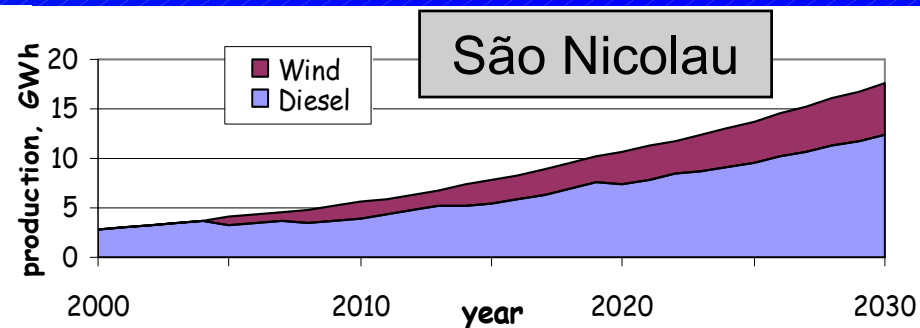
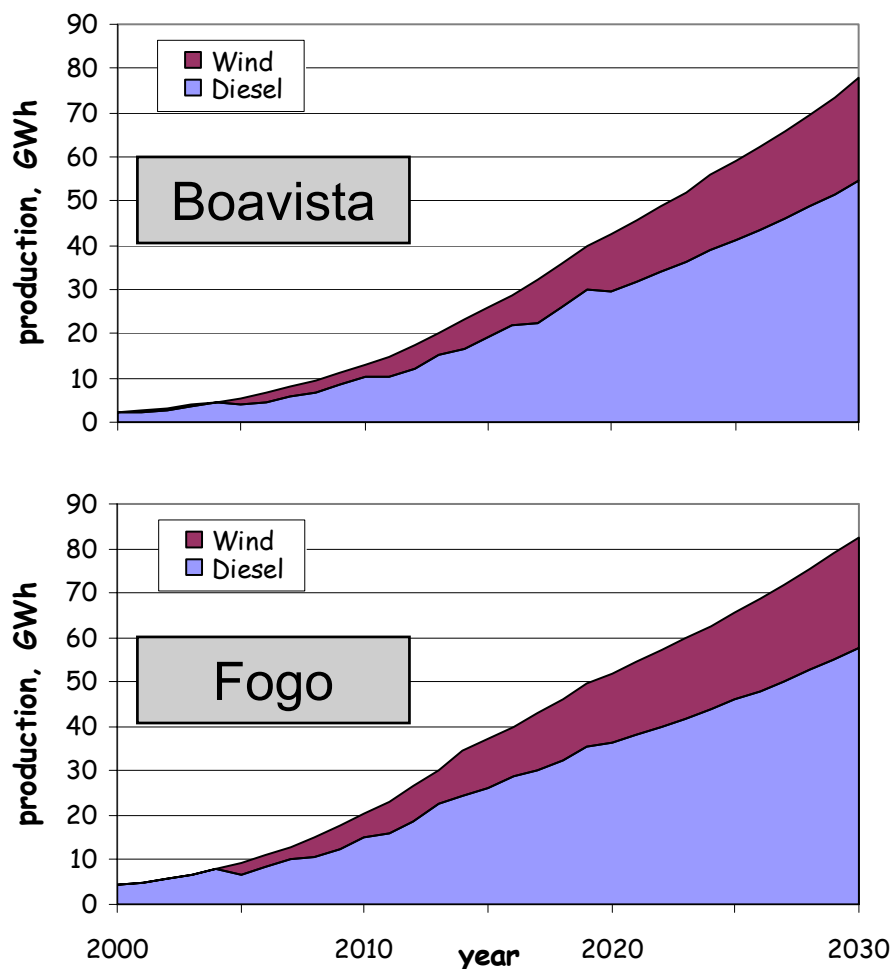
Economic scenaria	Electricity supply sceanria	SV	ST	SO	SA	BV	SN	FO	BR	MA
BAU	Baseline	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	30% wind	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	CC+30% wind	No	2010	No	No	No	No	No	No	No
Tourist paradise	Baseline	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	30% wind	Yes	Yes	Yes	Yes	Yes *	Yes *	Yes *	Yes *	Yes *
	CC+30% wind	2018*	2010*	2026*	2020*	No	No	No	No	No
Frontier	Baseline	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	30% wind	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
	CC+30% wind	No	2015	No	No	No	No	No	No	No

*shown

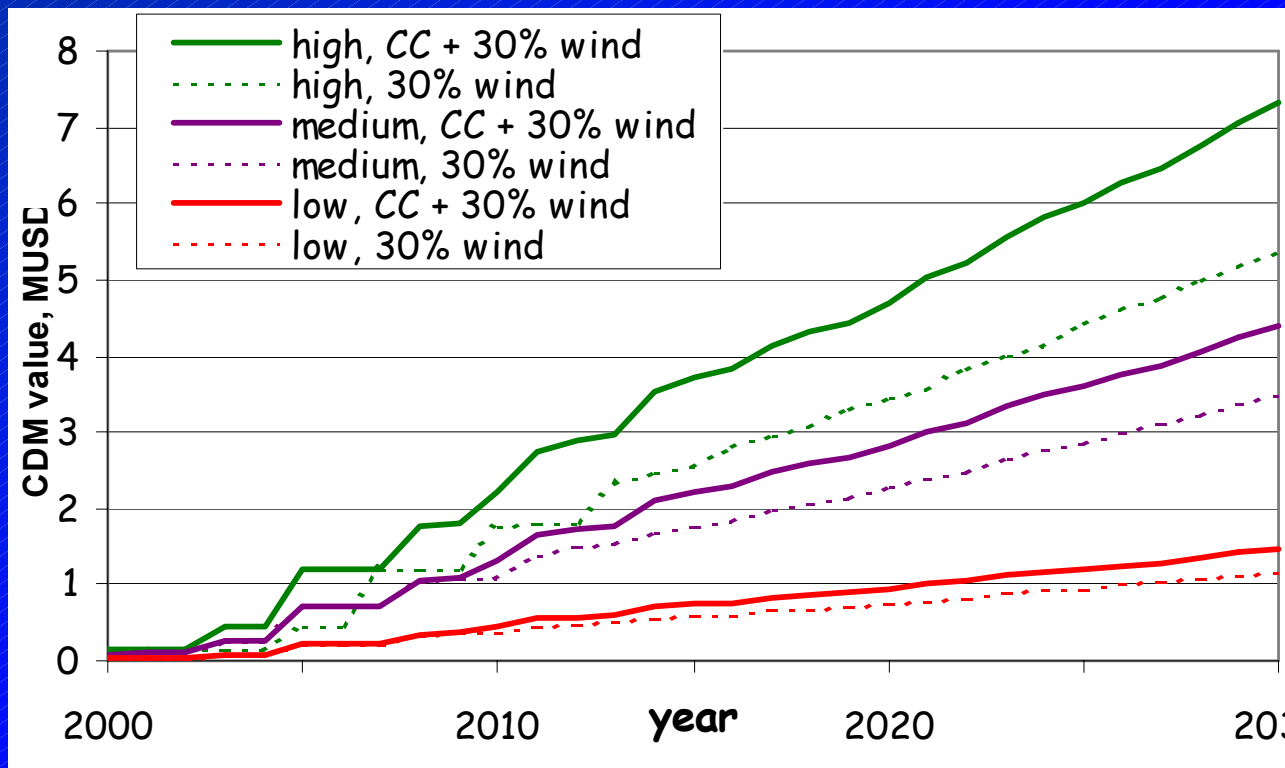
ELECTRICITY SUPPLY – REGIONAL



ELECTRICITY SUPPLY – REGIONAL



CDM SCENARIA

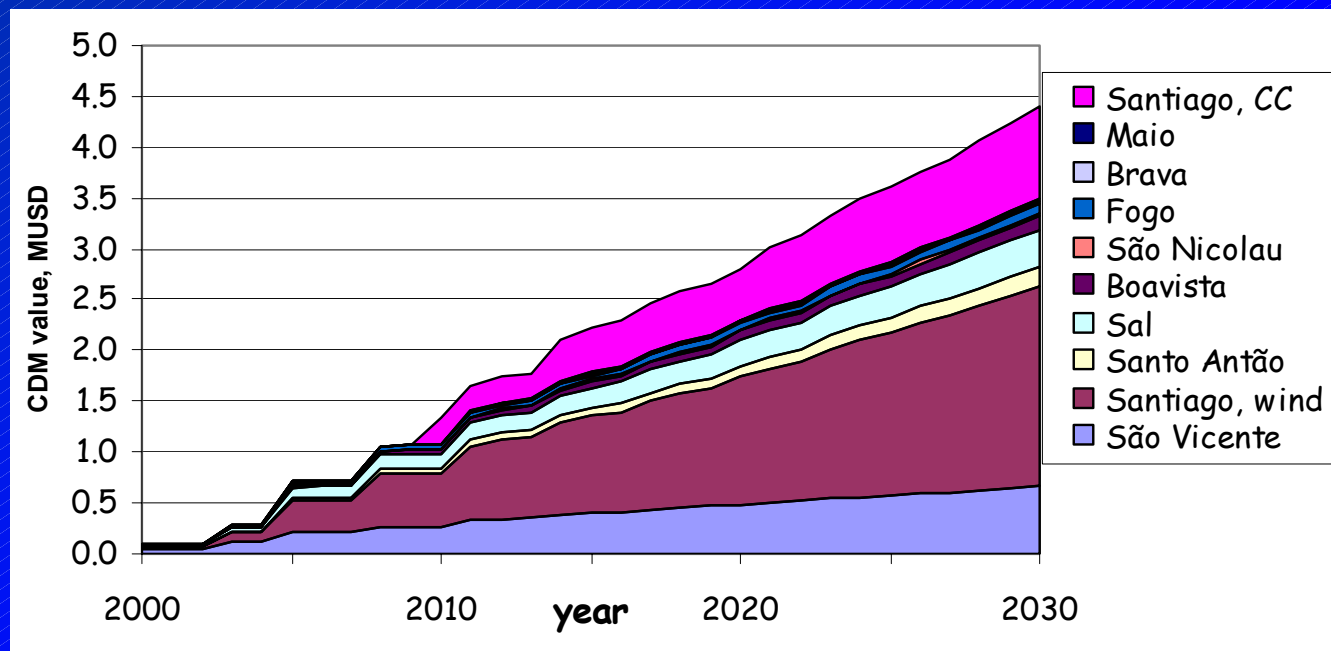


**CDM potential
for 2 electricity
supply scenaria
and 3 CDM
certificate
prices:**

- **High –
25\$/tCO₂**
- **Medium –
15\$/tCO₂**
- **Low –
5\$/tCO₂**

Business as usual economic scenarium

CDM VALUE

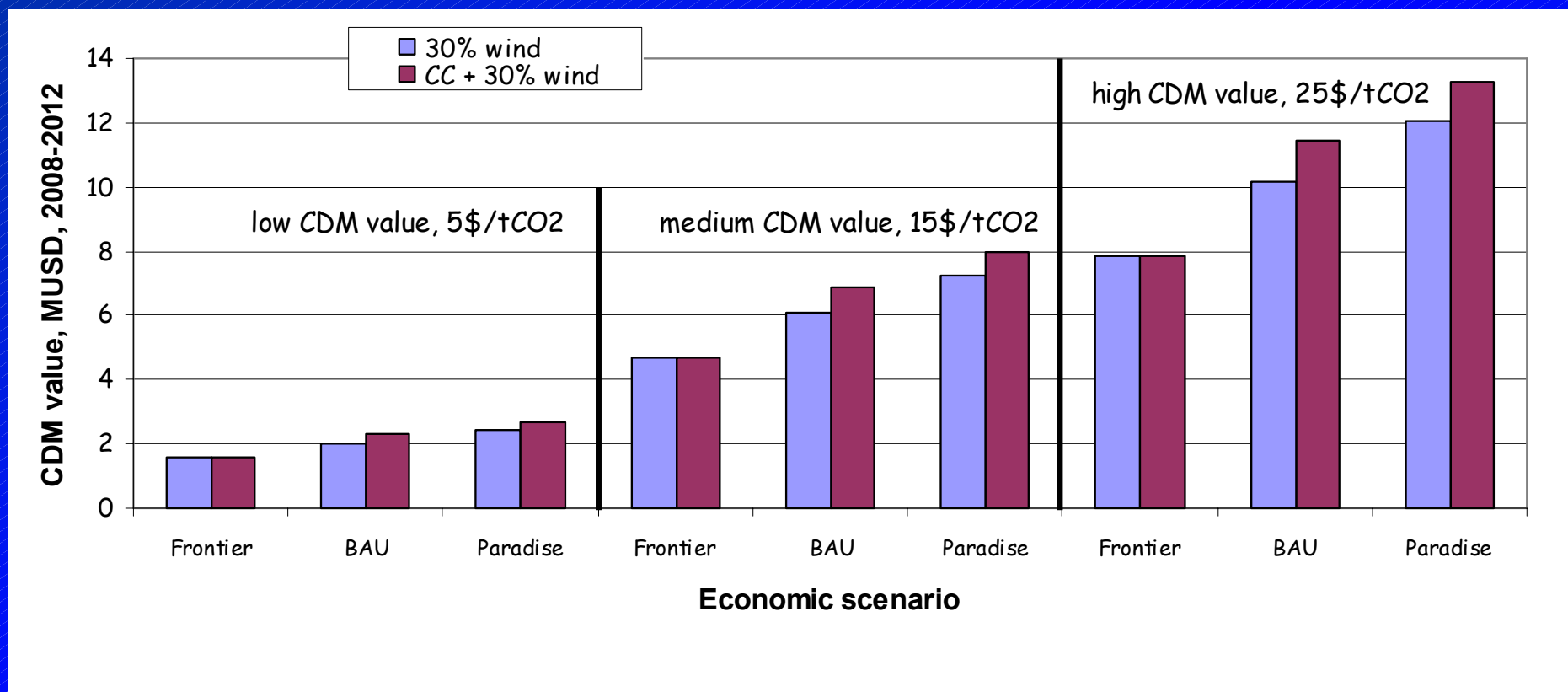


- Wind in all islands
- Combined cycle only in Santiago

Business as usual economic scenarium

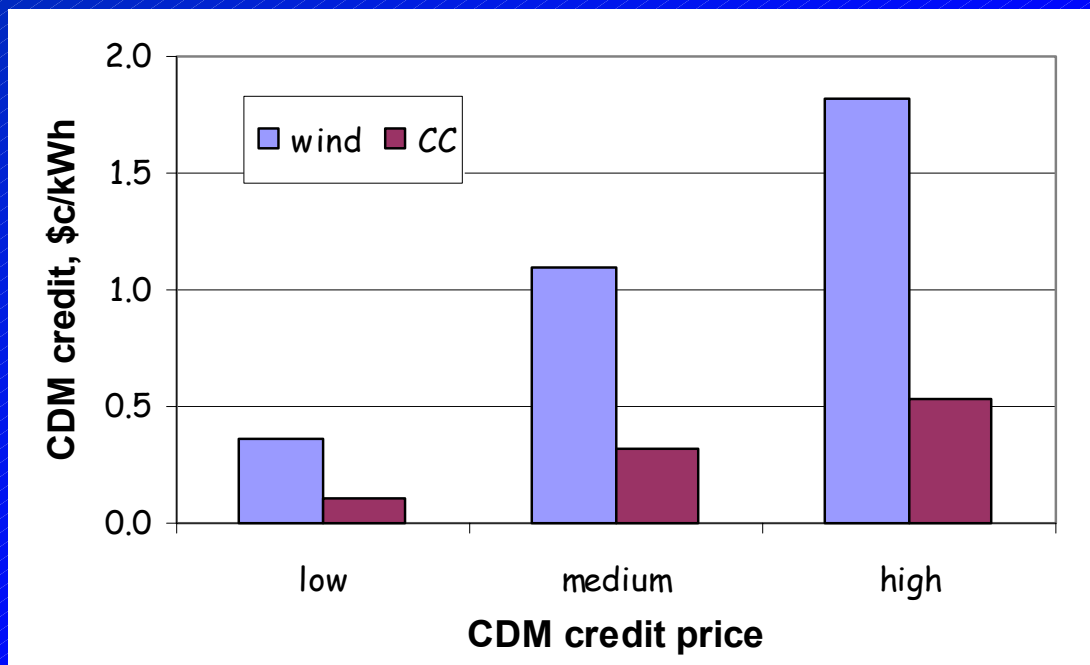
Medium CDM price scenarium – 15\$/tCO₂

CDM VALUE



2008-2012 – The First budget period of the Kyoto Protocol

CDM VALUE



- CDM – significant influence on electricity cost
- CDM for wind, up to 25% of the total price of kWh

CONCLUSIONS



- **Wind is good for islands**
 - **Security of supply**
 - **Competitive with Diesel**
- **CDM for islands**
 - **Big financial potential**
 - **Helps clean energy technology transfer**