

Leap into Green Growth: Promoting Clean Technology Manufacturing

Policy and regulatory issues: Brazil

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Initial Hybrid FiT-Quota Program (PROINFA)

- Two-phase program for wind, biomass and SHP
 - Contracts with ELETROBRÁS: 20 years
 - Levy on consumers > 80 kWh/month
 - Requirement of 60% national content in installations
 - Phase 1: 1,100 MW quotas for each tech. with FiT
 - Phase 2: 10% of national consumption in 20 years with annual purchase of 15% of annual increase
- 50% of reduction on wheeling fees
- Renewables for free consumers (over 500 kW)

Proinfa Implementation

- Phase 1: Bid in 06/04 – 3,300 MW (2006-2011)

		US\$/kWh
Small Hydro		3.7 (9.4)
Wind	CF \leq CFmin	6.6 (16.4)
	CF \geq CFmax	5.8 (14.4)
Biomass	Bagasse	3.0 (7.5)
	Rice straw	3.3 (8,3)

- Phase 2: Never implemented – vicious cycle
- New government came to power
 - Change from FiT to specific auctions

New Model (2004): universal auctions

- 100% of the energy bought in competitive bids
- Stated aim of reducing tariffs => fossil energy
- 4 years without new renewables: over 70% fossil fuel
- Renewable energy specific auctions from 2008
- Opportunism from over-supply of raw material (bagasse) and equipment (wind) due to financial crisis
 - Financing incentives by BNDES and BNB
 - Transmission facilities sharing access of biomass, wind, and small-hydro plants to National Grid
 - Tax and infrastructure incentives by state governments
- It still lacks a long-term strategy

Synthesis of last auctions

	R\$/MWh	US\$/kWh
Hydro	99.48	4.6 - 5,9
Small Hydro	144.00	8.3
Bagasse	144.60	8.5
Wind	148.39	7.7
Fuel oil	144.7*	8.3
Coal	140.00*	8.3
Natural gas	145.00*	8.0

* Not fully included the fuel costs

Conclusions

- Evident success of biomass and wind auctions
 - More than 3,200 MW purchased in 2 years
 - Wind prices dropped from 16.4-14.4 (at PROINFA) to 7.7 cents US\$ (2010 auction - 21% below cap-price)
 - 2011 auctions: competition between natural gas and wind with nearly 11 GW each, plus a component exclusive for renewables
- Attraction of manufacturing/assembling plants to the Country
 - Alstom, Gamesa, GE Energy, Vestas, Impsa, Enercon, Suzlon
 - Local manufacture of blades and towers

Legal Framework for Isolated Systems and Non-supplied areas

- Same subsidies awarded to diesel were extended to renewables (2002)
- Compulsory universal access up to 2015 (2002)
- Mini-grids or individual solar and wind systems accepted as an alternative to comply universal access mandate (2004)
- Flexible quality of supply for individual systems regulated by ANEEL (2004): size of systems and duration of outages
- Definition of technical and financial criteria, procedures and priorities to supply isolated communities with mini-grids, preferably making use of renewable energy (2009): pre-paid systems, 85% donations/soft loans, pilot projects to be replicated

PV Connected to Grid

- Pilot projects creating cases for regulation
 - 120 roofs installed by utilities, monitored by ANEEL, using R&D funds
 - Stadiums
- Public consultation on connection rules and net-metering, by regulatory agency: expected regulation by end of the year
- Proposal of a national strategy for promoting the national PV industry:
 - tax exemption, special credits and international partnerships,
 - needs assessment for production PV system equipment;
 - development of the technology for purification and silicon processing
- Integrators and assembling companies installed in the Country
- Committee established by ABINEE (Brazilian Association of Power Sector Equipment) for lobbying.

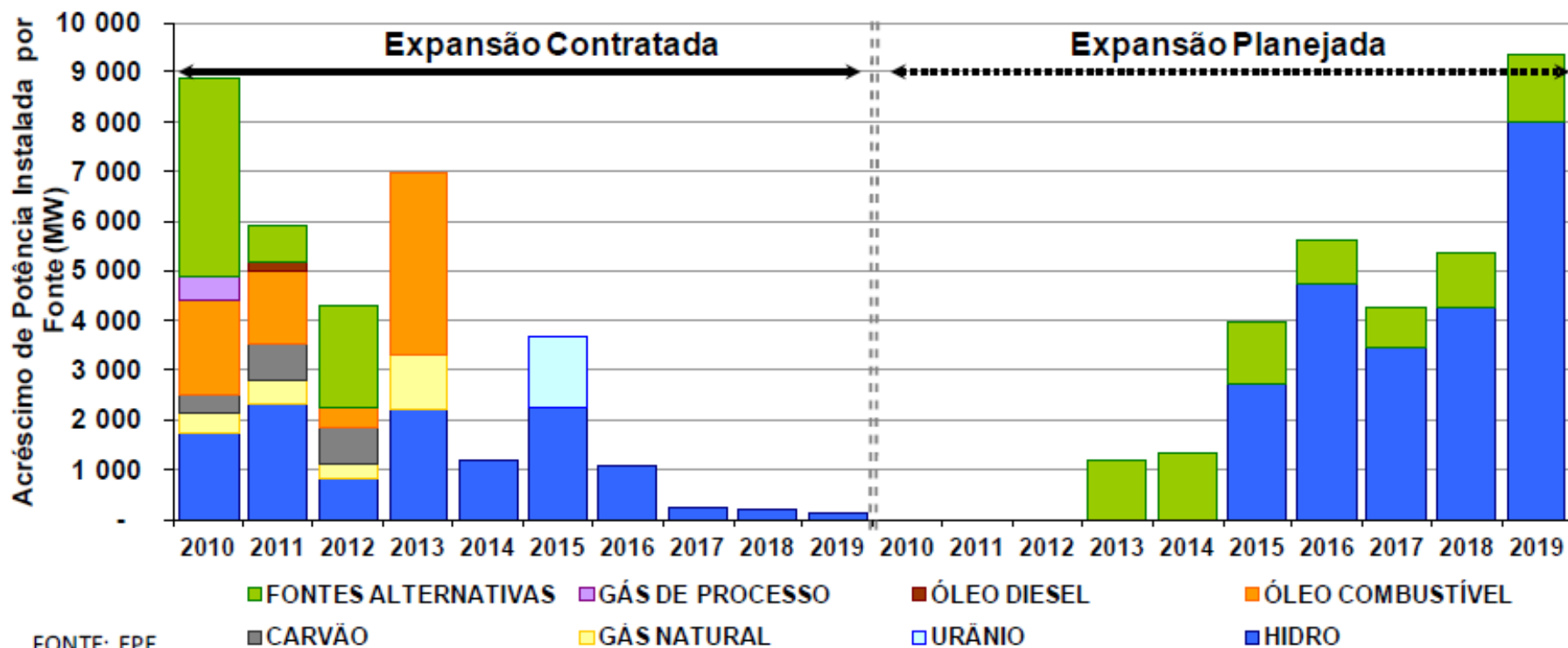
New Bill on Renewables: PL 630

- Annual purchase, for 10 years, through competitive bidding :
 - 200 MWmed from wind, biomass and small hydro each
 - 60% national content
 - 20 years
- Annual bidding of equivalent to 5% of annual increase from renewable projects: 50 kW < Power < 1.000 MW
- Compulsory acquisition of energy supplied by renewable micro-plants (< 50 kW)
- Utilities suppling isolated systems must bid their annual increases from renewable energy projects
- Residential and commercial consumers installing solar water heating will have 20% reduction in their tariffs
- Special fund to sponsor research and heat and power production based on from solar and wind energy

National Plan on Climate Change

- Power sector emissions reduction will be responsible for less than 1% national reductions (6% of emissions of energy sector)
- Cogeneration (mainly bagasse): 11.4% of supply in 2030
- New 34,46 GW of hydropower
- Reduction of non-technical losses from distribution utilities: 400 GWh
- Technology driven auctions
- Support on expansion of use of solar energy

2010-2019 Power Plan



No new fossil fuel forecast in future auctions, unless hydropower projects do not get environmental permits. Alternatives are natural gas and coal.

Why renewables?

- Reducing GHG emissions
- Reducing local pollution
- Decreasing reliance on imported fuels
- Foster a domestic industry and creating jobs
- R&D pushing technological development and future energy cost reductions
- Short construction times
- Complementarity with large dams where they exist
- Simpler environmental licencing compared with large dams
- Smaller investment costs and higher number of investors
- Many projects resulting a hedge against project delays

Why invest in a particular site?

- Strategic location;
- Availability of natural resources: solar, wind, land for biomass;
- Local availability of raw materials and commodities;
- Workforce;
- Technological support: universities and research centers;
- Political-administrative and regulatory reliability;
- Market and quality of life;
- Balanced public finances;
- Availability of areas for industrial plants;
- Tax and financial incentives.

Links in value chains for solar, wind and hydro energy solutions

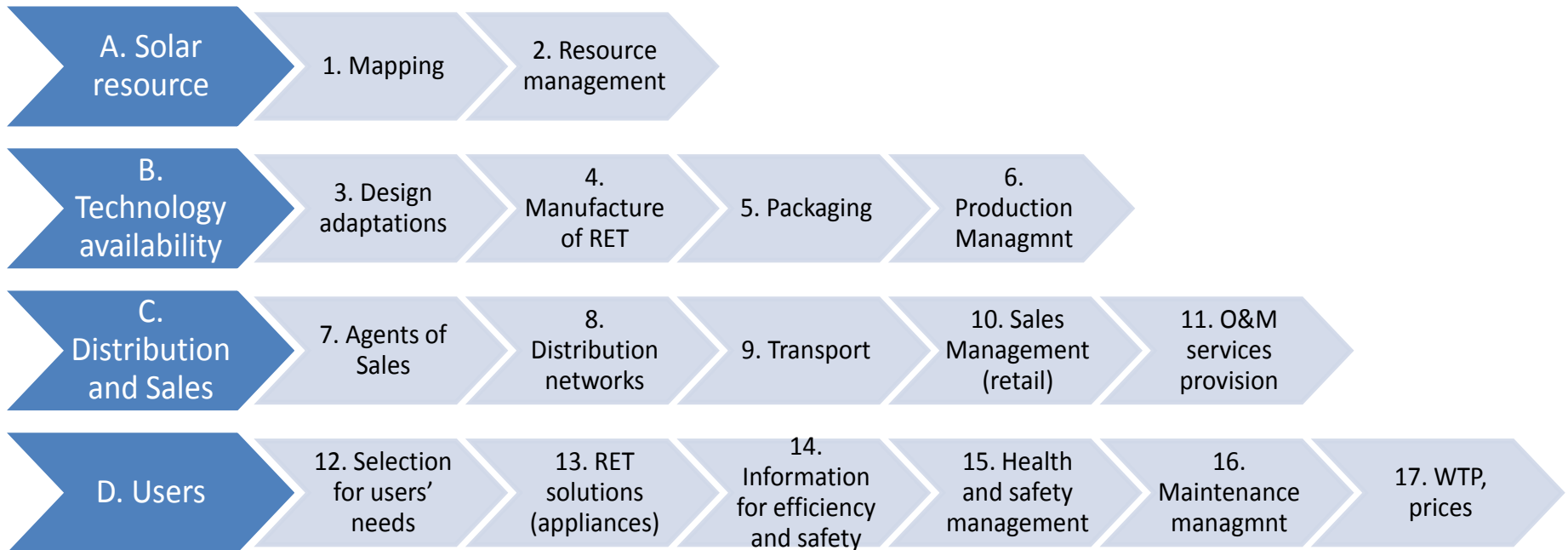
- Renewable Energy Resource
 - Mapping
 - Resource Management
- Technology availability
 - Design adaptations
 - Manufacture of technology
 - Quality standard and tests
 - Packaging
 - Production Management
 - O&M Management
- Markets
 - Agents of sales
 - Market regulation and taxes
 - Distribution networks
 - Transport
 - Sales Management (retail)
 - O&M services provision
- Users
 - Selection for users' needs
 - RE technology solutions
 - Information for efficiency and safety
 - Health and Safety Management
 - Maintenance management
 - Willingness to pay / prices

Supply & Demand (S&D) chain for solar energy

Regulation and Taxes

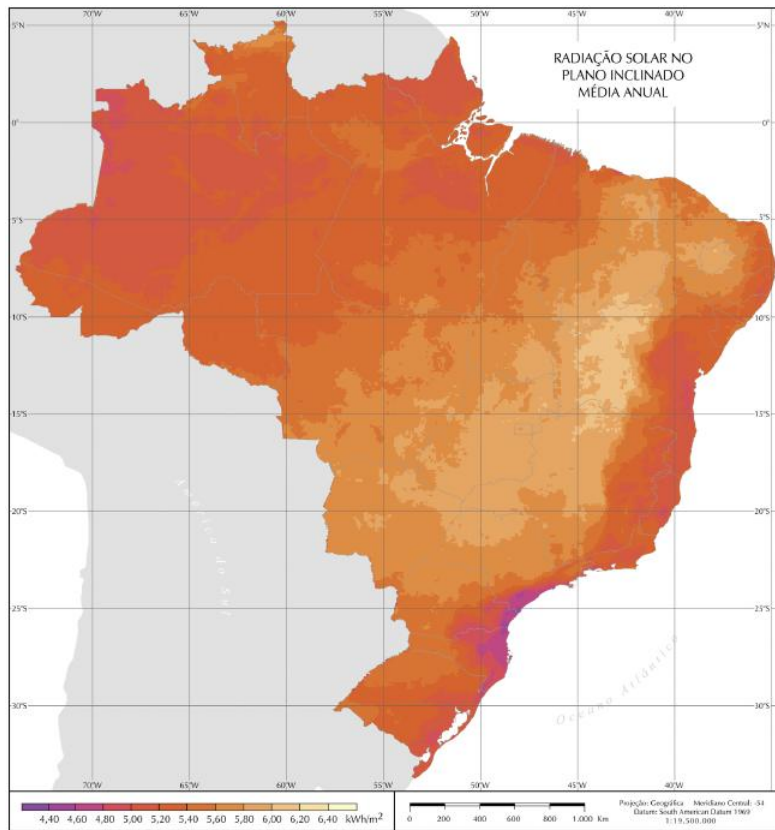
Quality Standards

Environmental Impact Mitigation and Management

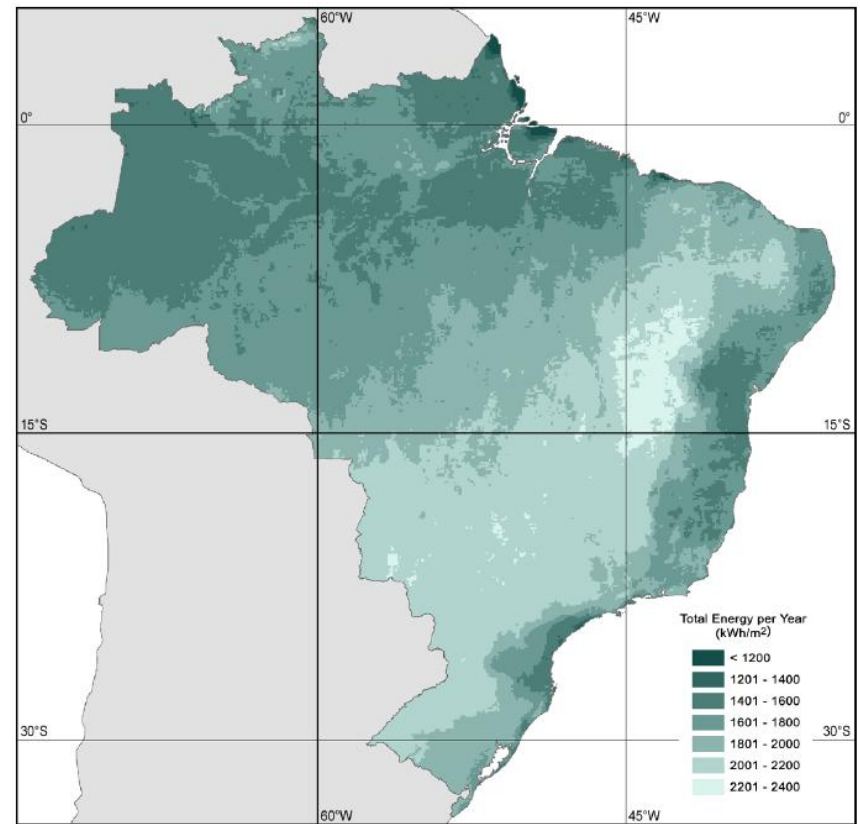


Resource Assessment: Solar Energy

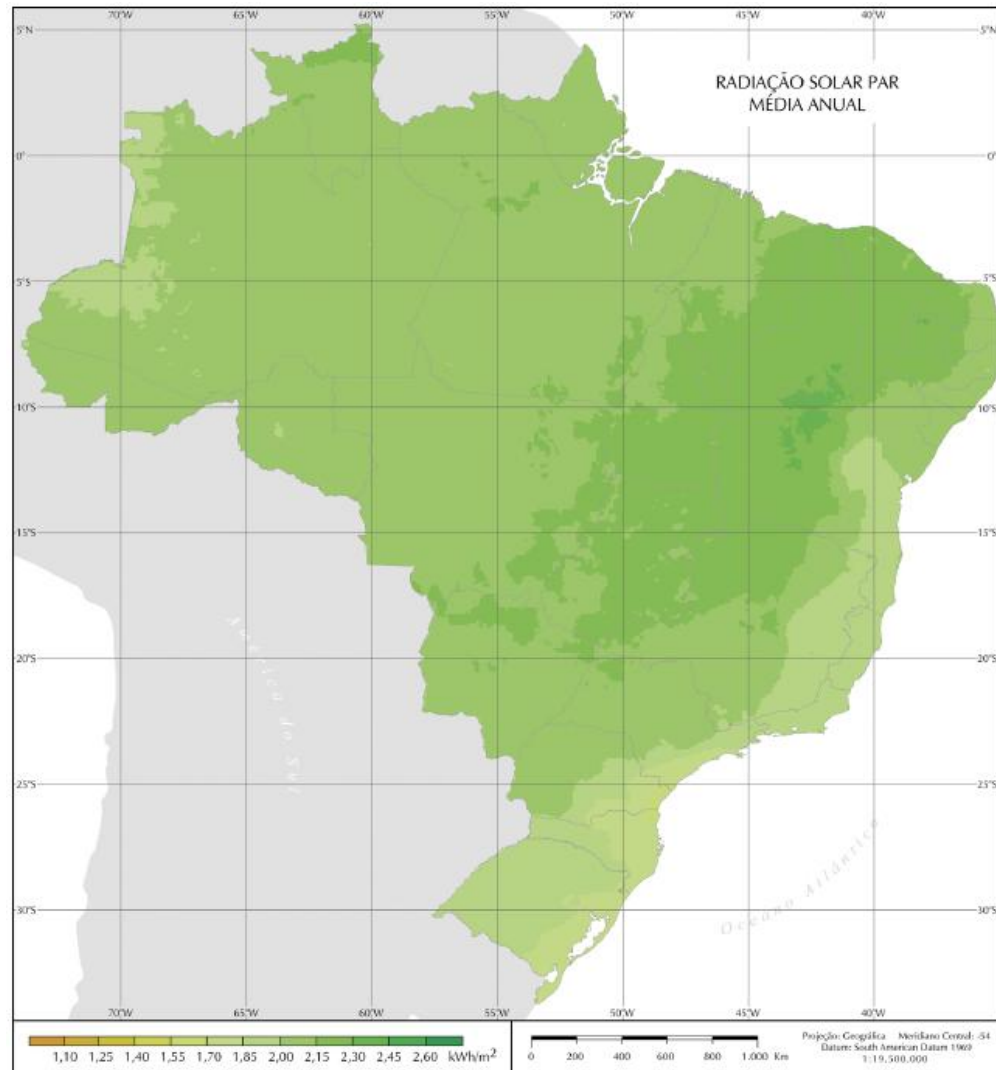
Tilted



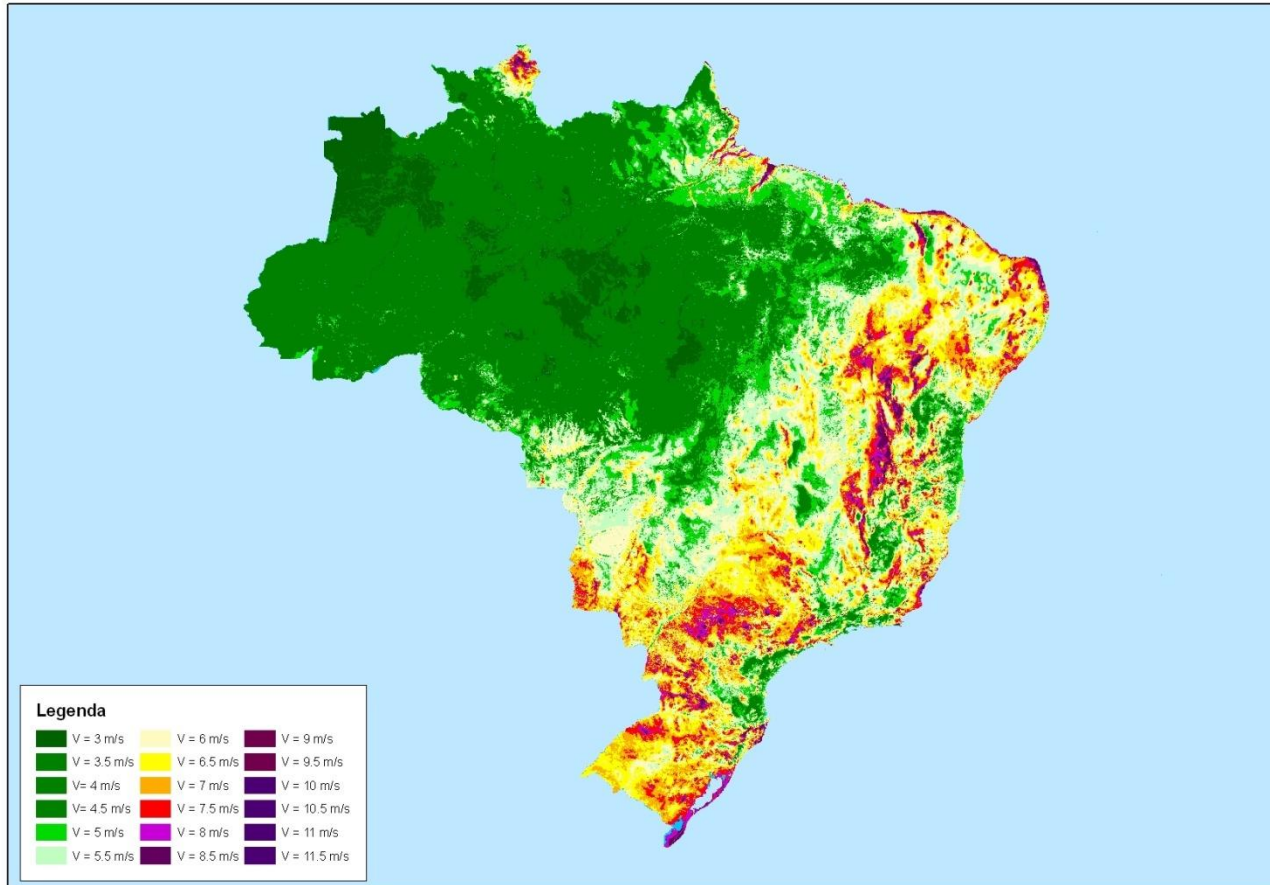
Direct radiation



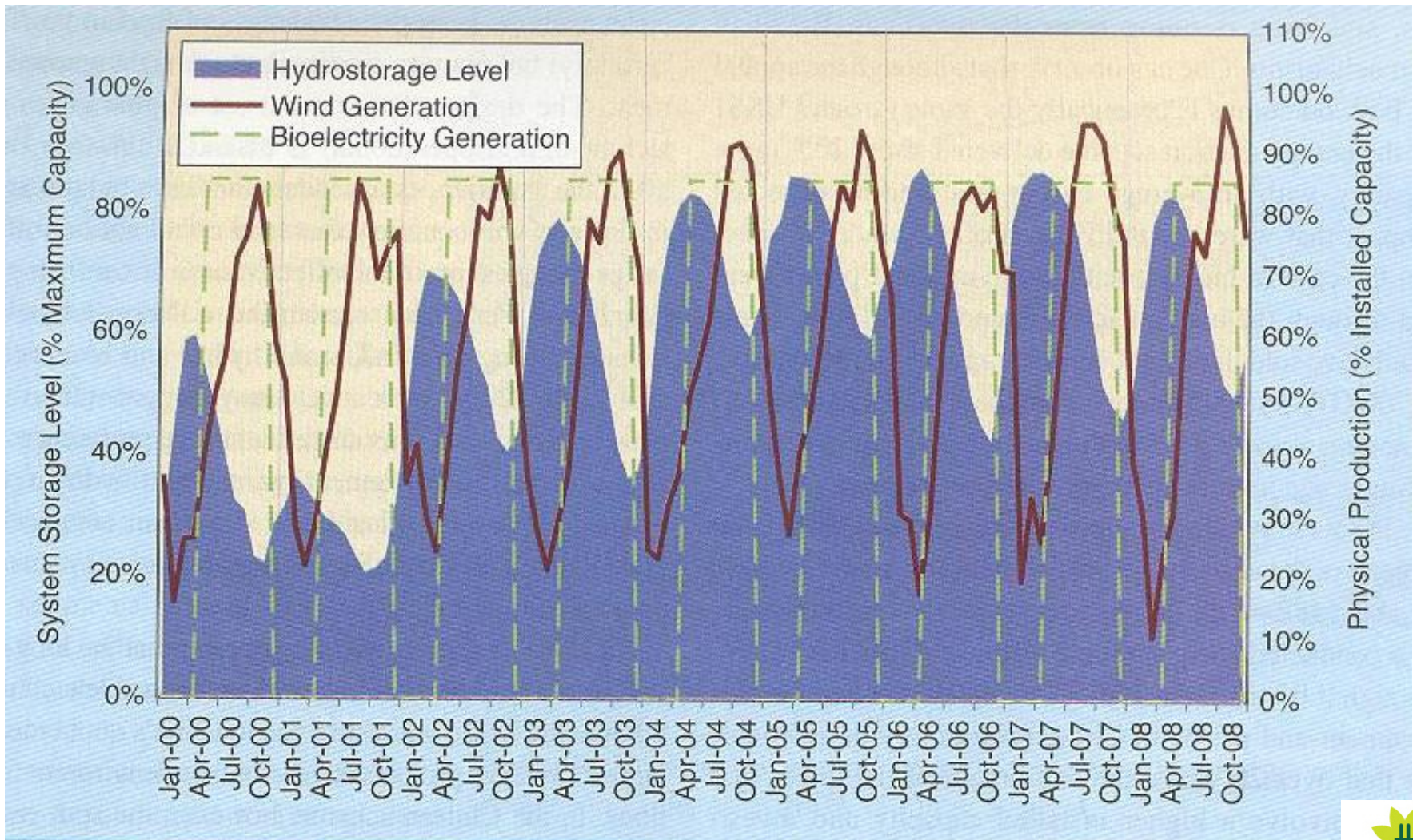
Resource Assessment: Biomass



Resource Assessment: Wind



Complementarity of hydro storage and wind and biomass resources



RE Policy Mechanisms

- Feed-in tariff or premium payment
- Renewable portfolio standard => quotas/mandates
- Tendering (reverse auctions)/Bidding
- Tradable Certificates
- Energy production/power investment tax credits or payments
- Reductions in taxes (VAT, sales, energy or other taxes), accelerated depreciation
- Investment grants, subsidies, rebates
- Public Finance: equity, loans, grants, guarantees
- Net metering
- Priority dispatch/access to network
- Public procurement
- Green energy purchasing, labeling, guarantee of origin

Feed-in Tariffs

- Premium price paid to an electricity generator to feed renewable energy onto the grid.
 - ✓ Long-term payments based on generation cost, or as a fixed premium on top of the spot market price for electricity
 - ✓ Subsidy to energy produced, not to installed capacity
 - ✓ Mandatory connection of all eligible renewable energy generation, up to a specified limit per year
 - ✓ Possibilities:
 - ✓ existence of cap on installed capacity, size of projects
 - ✓ tendering system
 - ✓ regular adjustment of tariffs, built into law, to reflect changes in technologies and the marketplace
 - ✓ differentiated tariffs by technology type and project size
 - ✓ Applied in over 50 countries and 25 states/provinces

Renewable Portfolio Standard – RPS

- Requirement of electric power utilities to source a specified proportion of their power from renewable sources
 - ✓ Mandatory, long-term targets, accompanied by clear enforcement mechanisms
 - ✓ Possibility of flexible mechanisms for compliance (tradable certificates with minimum prices)
 - ✓ Possibility of quotas for specific technologies
 - ✓ Applied in 10 countries and 46 states/provinces

Tendering/Bidding

- Reverse auctioning
 - Public authorities organize tenders for given quota of RE supplies or supply capacities
 - It can remunerate winning bids at prices mostly above standard market levels
 - Deployment of a set quantity of renewables at least cost
 - It can be conducted by the government itself, or the government can require a utility to conduct a reverse auction for a specified amount of generating capacity.
 - Solid track record of rapidly delivering large quantities of renewables at low costs
 - It has been applied in Brazil and Peru (wind: 150 MW/0.8c smallhydro: 160 MW/0.6, solar: 90 MW/0.22)

Net Metering

Contract between the utility and consumer to negotiate surplus on distributed generation

- ✓ Allows a two-way flow of electricity between the electricity distribution company and customers with their own generation
- ✓ Consumer pays regular tariffs when consumption is higher than generation. In the case of generation is higher than consumption, the utility pays avoided cost or regular tariff
- ✓ The customer pays only for the net electricity delivered from the utility (total consumption minus self-production)
- ✓ The meter flows backwards when power is fed into the grid
- ✓ It requires a bidirectional meter
- ✓ No concern on coincidence between generation and consumption, no batteries required.

Law 10.438/2002

- Renewable Energy Program (PROINFA)
- Wind, biomass, small hydro or solar projects up to 30 MW to supply free consumers
 - higher than 500 kW
- Sector Fund (RGR): 10% to wind, solar, biomass and smallhydro
- Special Program to solar energy (pilot projects)
- 50% of reduction on wheeling fees
- Self generation using renewables is allowed

PROINFA

- Phase I
 - Contracts with ELETROBRÁS: 20 years
 - 3.300 MW (1/3 for each source: wind, biomass and SHP): quotas by technology
 - Economic Value (FiT) to be defined by Ministry
 - Levy on consumers > 80 kWh/month
 - Limits by states 20% (B & W) and 15% (SHP)
 - **60% of national content**
 - Priority dispatch

PROINFA

- Phase II: Never implemented
 - Once reached the target of 3.300 MW: 10% of national consumption would be supplied by wind, biomass and SHP in 20 years
 - Annual purchase of 15% of annual increase from these sources
 - 20 year contracts by Eletrobras
 - Renewable Energy Certificate
- New government came to power
 - “Premium tariff makes pressure on electricity tariffs penalizing the consumer”

Implementation of PROINFA

- Very low premium tariff to biomass → part of the quota reallocated to wind and small hydro
- Greatest difficulties to wind projects:
 - National content
 - Vicious cycle: no second phase, no manufacturing
 - Capacity factor
 - Small investors, change in shareholder composition, speculation
- Lack of economic signals for technological improvement
- Deadline for installation extended to 2011
- Fiscal and financial incentives

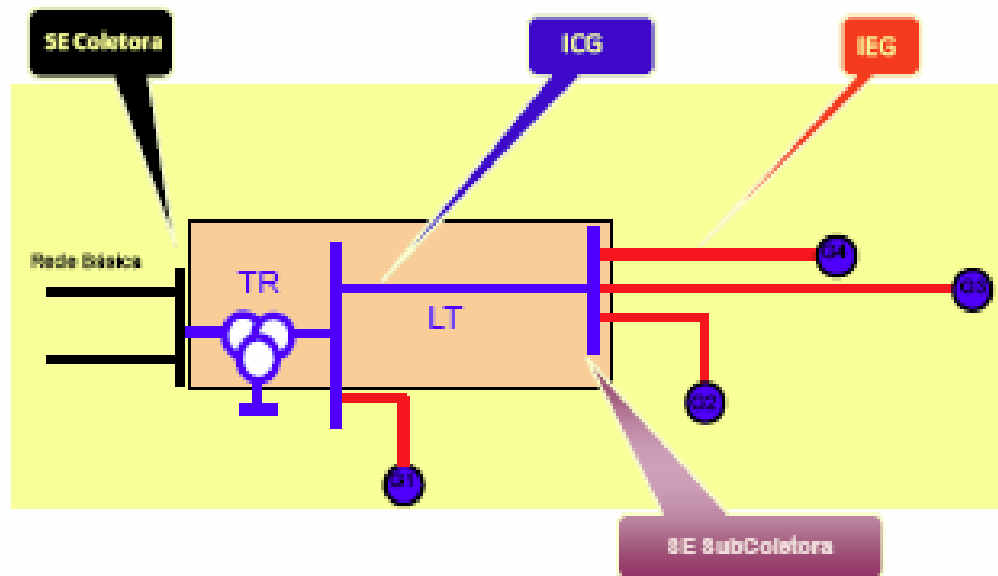
Law 10.848/04: New Model to Power Sector: Two Markets

- Regulated Market: distribution companies
 - 100% of the energy bought in competitive bids
 - Contracts in pool → generators and discos
 - Guaranteed revenue for the generators - Bid for lowest price
 - Long-term contracts
- Free Market
 - Contracts freely agreed ==> free consumers, IPPs, dealers
 - Bilateral contracts: short to medium-term

ICG's

Transmission facilities sharing access of biomass, wind, and small-hydro plants to National Grid:

- Reduced costs of connection to entrepreneurs
- Alternative to Basic Grid (≥ 230 kV)
- Reduces difficulties imposed by utilities
- 2 or more plants



Fonte: EPE

Fiscal Incentives

Federal Taxes:

- 75% reduction on income tax.
 - *This benefit applies only to projects in Northeast Brazil.*

State taxes:

- Reduction of 56%, 64% or 81% on VAT due from monthly sales, for a period of up to 12 years, depending on the nature of the project, its location etc.

Municipal Taxes:

- Most cities give a reduction or exemption of taxes.

Financing incentives

Brazilian Development Bank

- Finances up to 80% of total investment - requirement of 60% national content

Brazil Northeast Bank - BNB

- Soft loans for larger projects (lower rates)
- It is restricted to Northeastern states.

State Government Financing Agencies - DESENBAHIA (p.e.)

- Loans at lower rates for investments of up to US\$ 25 million and for working capital.

Infrastructure

- Areas for industrial facilities at symbolic prices:
 - *In all industrial districts;*
 - *In specific locations.*

Supply of water, electricity, gas and telecommunications, up to plant gate, as well as road access.

Special auctions for new generation (alternative and reserve energy)

Year	Type	Projects	MWmed
2007	Renewable (biomass/SHP)	18	186
2008	Biomass*	31	1,204
2009	Wind**	71	783
2010	Renewables	89	1,159.4
Total		209	3,332.4

Opportunistic motivations:

* Ethanol boom of 2006-2007

** Lower equipment costs: 2008/09 world financial crisis

First wind energy auction: December 2009

- Beginning of supply: January 2012, for 20 years
- At least one year of wind measurements
- 4-year adjustments: +/- 10% transferred to following year
- CER (CDM) will not affect bid prices



- 1,805.7 MW → 783 MWmed: capacity factor = 43,3%
- Low prices: 21.5% below cap price, wind became competitive with conventional thermal power
- Over production of equipment in international market
- Strong success (low prices) assured new auctions in 2010 → attraction of manufacturing plants:
 - Alstom, Gamesa, GE Energy, Vestas, Impsa, Enercon, Suzlon

2010 A3 and Renewable Energy Auctions

- Wind:
 - 70 projects
 - 899 MWmed (2,047.8 MW → cf = 44%);
 - **7.7 US\$¢/kWh** (21,6% below cap price)
- Biomass
 - 12 projects
 - 190.6 MWmed (712.9 MW → cf = 20%);
 - **8.5 US\$¢/kWh**
- Small Hydro
 - 7 projects
 - 69.8 MWmed (131.5 MW → cf = 53%);
 - **8.3 US\$¢/kWh**

Renewables in Mozambique case

- Rate of electrification: 29% (19% rede, 10% renew)
- Natural resources: hydropower and coal
- Need of bilateral and multilateral partners
- National Renewable Energy Plan to improve the access to modern fuels, develop and use of RET and promote private investment
 - Resource assessment: wind, small hydro, geothermal and ocean energy
 - Local manufacture of solar heaters, low-price PV panels, wind pumping systems and equipment for biodigesters
 - Regulation: licensing, FiT , Grid code and off-grid tariffs

Mozambique case: Key actions

- Installation of PV systems for lighting (50,000), fridges (5,000), TVs (2,000), water pumping (5,000) and community services (20,000); biodigesters (1,000); wind pumping systems (3,000), RET productive systems (5,000) and solar heaters (100,000)
- 100 MW of wind power
- 125 MW of small hydro
- 3 bagasse power plants
- Road-show and workshops
- MDL Agence

Other relevant issues

- Technology choice and feasibility studies
- Grid analysis and integration issues
- Regional transmission systems, cross-border power trading and grid operator
- Clean energy across the borders (MZ-SA) and improve security of supply
- Rural Electrification models
 - Kenya, Argentine, Brazil, Tanzania/Zambia
- PPP and role of local banks
- 1 CDM project proposed, but rejected, 58 projects registered in Africa (1,95%)

GET FiT Program

- Global Energy Transfers: Feed-in Tariffs for Developing Countries
- DB Climate Change Advisor
- Payment of portion of premium
- Lack of financial strength, grid infrastructure and regulatory framework
- Deployment of advanced FiT designs
- PPA's as a pre-FiT regulatory mechanism
- Adaptation of FiT principles to create performance based incentives for decentralized multi-user energy generation
- Role for the Green Climate Fund?

Areas of cooperation

- Policy design
- Regulatory framework
- Institutional strengthening
- Resource assessment
- Analysis of cost competitiveness and feasibility studies
- Technical and engineering issues, particularly grid infrastructure
- Project development issues
- Financial strength

Role of Key Emerging Economies:

China, Brazil and India

- Support on policy design and regulation
- Renewable energy technology
- Technical expertise
- Funds for infrastructure development
- Commercial available technologies in South-South Cooperation:
 - China: solar and wind power technology
 - India: biomass gasefication
 - Brazil: use of bagasse and biofuels

Conclusions

- Evident success of biomass and wind auctions
 - More than 3,200 MW purchased in 2 years
 - Wind prices dropped from 16.4-14.4 (at PROINFA) to 7.7 cents US\$ (2010 auction - 21% below cap-price)
 - 2011 auctions: competition between natural gas and wind with nearly 11 GW each, plus a component exclusive for renewables
- Attraction of manufacturing/assembling plants to the Country
- Changes in international market could affect Brazilian Model? Installed manufacturing plants would minimize it? If no, would be necessary FiT?