



GRUPO BANCO MUNDIAL

 **FGV CER**

*Centro de Estudos
em Regulação e
Infraestrutura*

DISTRIBUTED ENERGY RESOURCES

CHALLENGES, OPPORTUNITIES AND PERSPECTIVES

SCOPE OF A COMPANION PAPER COMMISSIONED BY THE WB

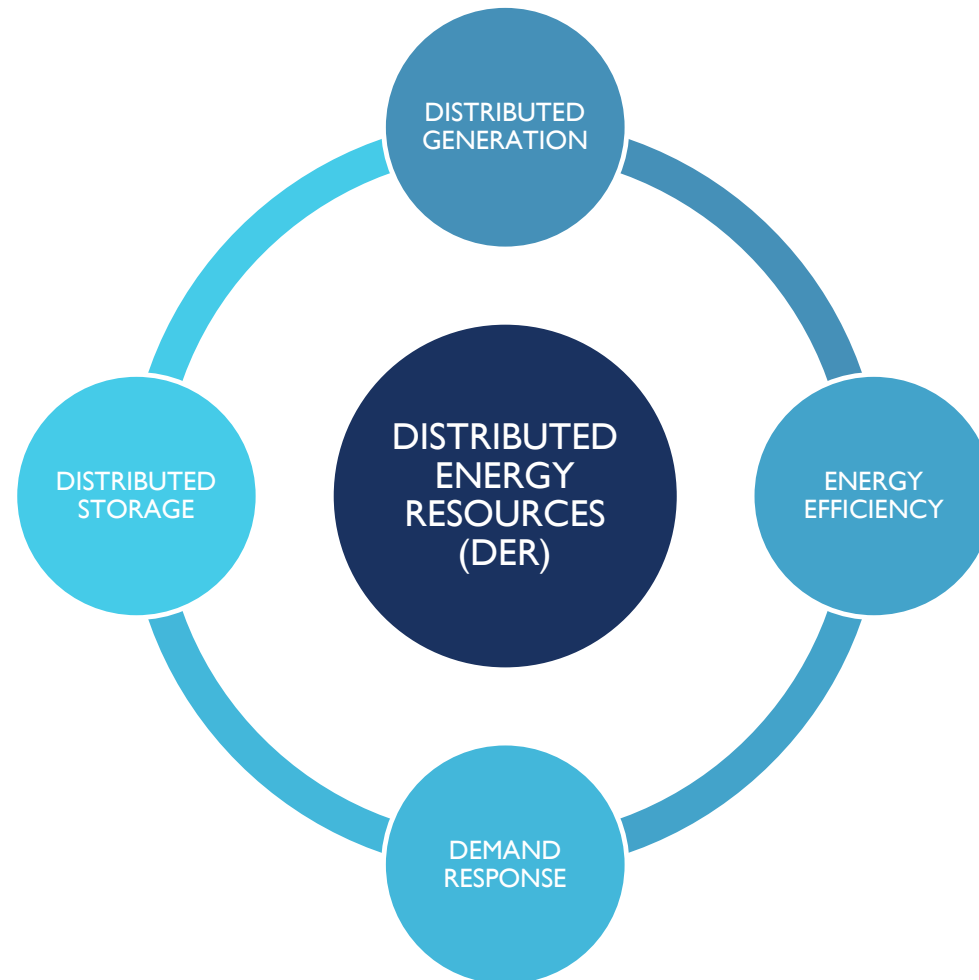
Assess the DER disruptive technologies in the electricity industry worldwide and its impact in Brazil

The need to promote regulation adaptation towards new/emerging business models able to foster disruptive technologies

ROADMAP OF THIS PRESENTATION

- The Concept of Distributed Energy Resources
- Increasing Penetration of DER
- Consequences for the Utility Business Model
- DER Penetration in Brazil
- Adapting Regulation to DER Penetration in Brazil
- Concluding Remarks

DISTRIBUTED ENERGY RESOURCES



DISTRIBUTED ENERGY RESOURCES = DG + DSM

Distributed Power Generation and Storage Resources

- Power Generation (DG)
- Distributed Energy Storage (DES)

Demand Side Management (DSM)

- Changes in electric usage by end-use customers
- Response to changes in prices or incentive payments to lower electricity usage (quantities)
- Energy Efficiency

Distributed Energy Systems (DES)

- DERs combined with ICT plus intelligence

Our focus is on DER typically located on customer's premises - "Behind the Meter"

In most cases green

THERE IS AN INCREASING TREND OF PENETRATION OF DERs

Increasing difficulties with the construction of new hydro plants with storage capacity.

Reduction of GHG emission.

Growth of new renewable energy sources:

→ higher presence of intermittent generation requires more flexibility from the power system.

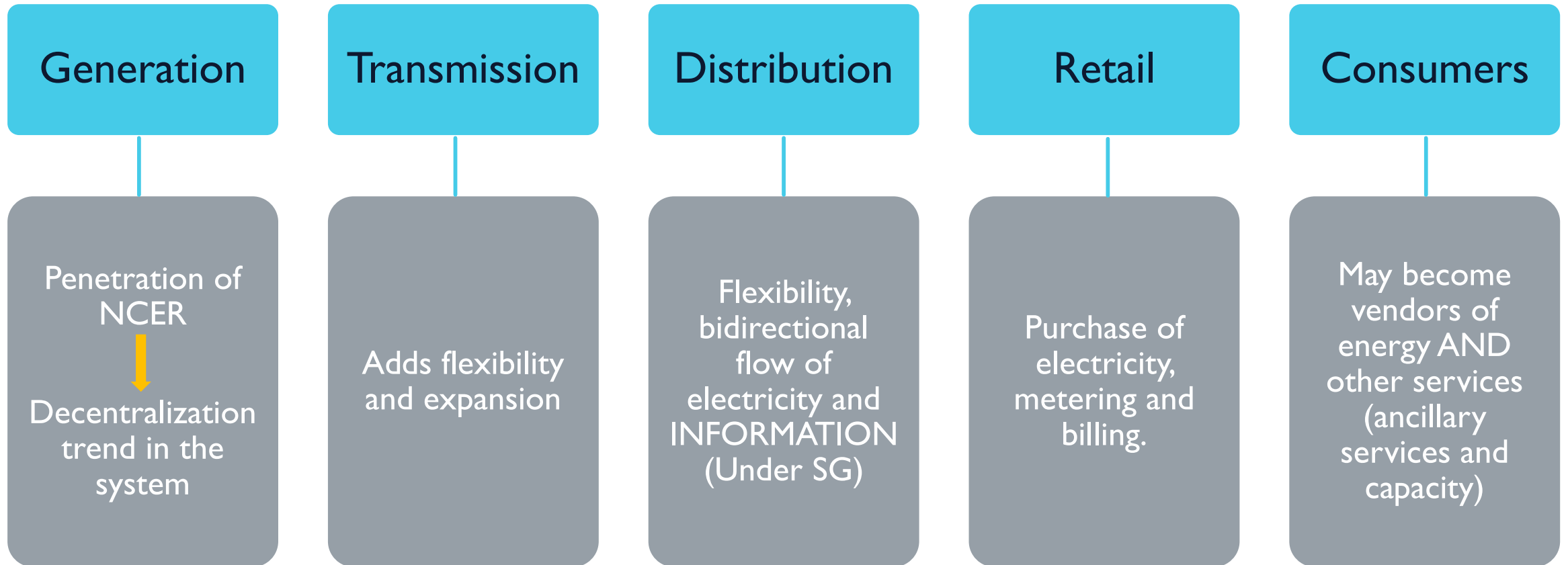
The cost of non-grid scale (rooftop solar and associated batteries) renewable electricity generation is declining.

DERs are **RESOURCES**.

INCREASING PENETRATION OF DERs

- Increasing the amount of DERs represents both a challenge and an opportunity for grid operators
 - Requires modernization of the grid; e.g., Smart Grids – digital technologies .
 - Can contribute to the grid adequacy and reliability

DERs ARE ADDING NEW ROLES AND FUNCTIONS TO THE TRADITIONAL PLAYERS



THE NEED FOR A NEW REGULATORY FRAMEWORK

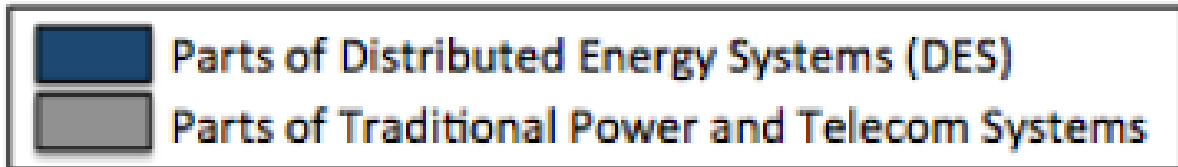
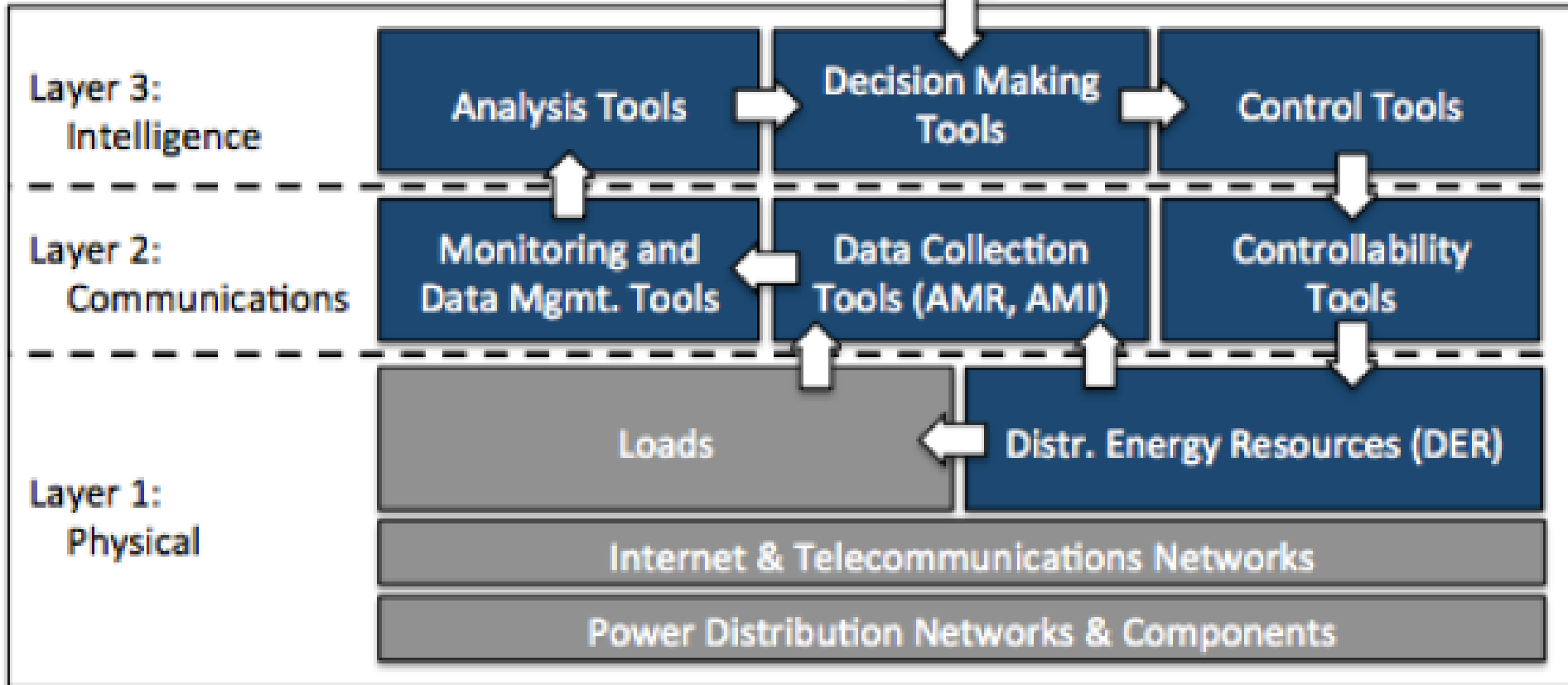
Government should provide a sound regulatory and policy environment for stakeholders to seize the OPPORTUNITY

End-users may become vendors of energy AND other services
(ancillary services, capacity)

Utility of the future?

Aligning cost recovery mechanisms of electric distribution utilities and incentives for the integration of DERs and DESs

Input defined by Business Model & Systems Environment (Regulation, Market, etc.)



ROADMAP FOR DISTRIBUTED GENERATION

On-site energy production

Intermittent source, BUT

Can also contribute to the system safety (smart inverters)

Net metering: important step, but raises economic efficiency issues

Participation of new actors (new BM) in financing instalation

Supply chain is still not developed

- Cheaper for the consumer
- Clean
- Closer to consumption center

THE CONSEQUENCES OF DISTRIBUTED GENERATION FOR THE UTILITY (BUSINESS MODEL)

The net metering scheme helps boost the adoption of solar PV, BUT has some drawbacks

- No explicit payment for the use of the grid
- Distorts price signals
 - Value of energy produced/consumed not time-based

Regulators and Policy-makers: how to make solar generation financially attractive?

- Win (utilities)
 - Win (DG adopters)
 - Win (non-adopters)

Services:
installation, financial operating, and maintenance.

Aggregation of several plants. PV solar integrator

- **For the system:** gains from coordination.
- **For consumers:** reduction of various costs.
- Utility can play a key role

DG can also provide ancillary services (smart inverters)

New BM to capture the value created by the aggregation

Customer-side business model:
more active management of customer interface

ARE WE READY FOR A MASSIVE DEPLOYMENT OF DG?

Regulation is not ready

- The deployment of DGs (and other DERs) distribution network requires modernizing the T&D grids (more investment in ICTs and expenses go from CAPEX to OPEX)

Participation of DERs in markets must be promoted

- Energy, and ancillary and capacity services provision.

Timing is Important

- Accessible storage technology likely in the longer-term.

» Regulation must provide adequate remuneration and incentives mechanisms.

PENETRATION OF DG IN BRAZIL

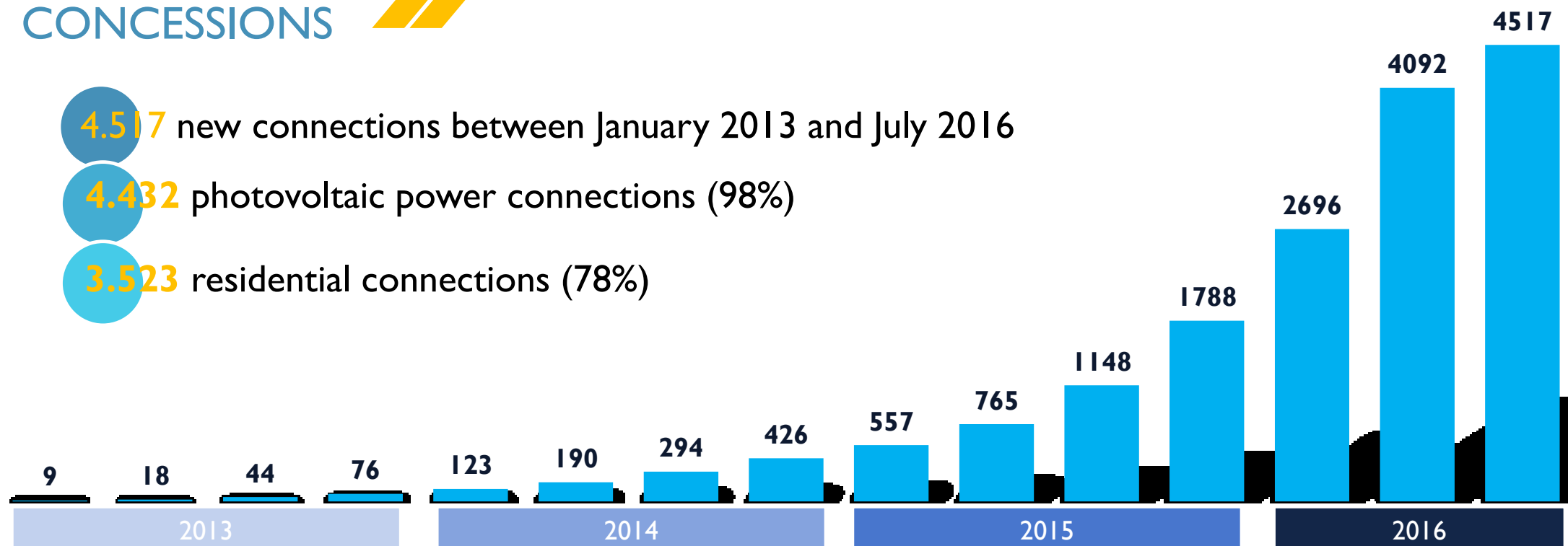
NEW CONCESSIONS



4.517 new connections between January 2013 and July 2016

4.432 photovoltaic power connections (98%)

3.523 residential connections (78%)



ROADMAP FOR DEMAND SIDE MANAGEMENT (DSM)

DSM are changes in energy consumption pattern to foster better efficiency and operations.

- System safety and reliability
- Economic side: load reduction when cost of energy is high.
- Displacing most expensive generation to the stack

Demand Side resources are still underutilized in Brazil.

The current volumetric tariff design weakens utilities incentives.

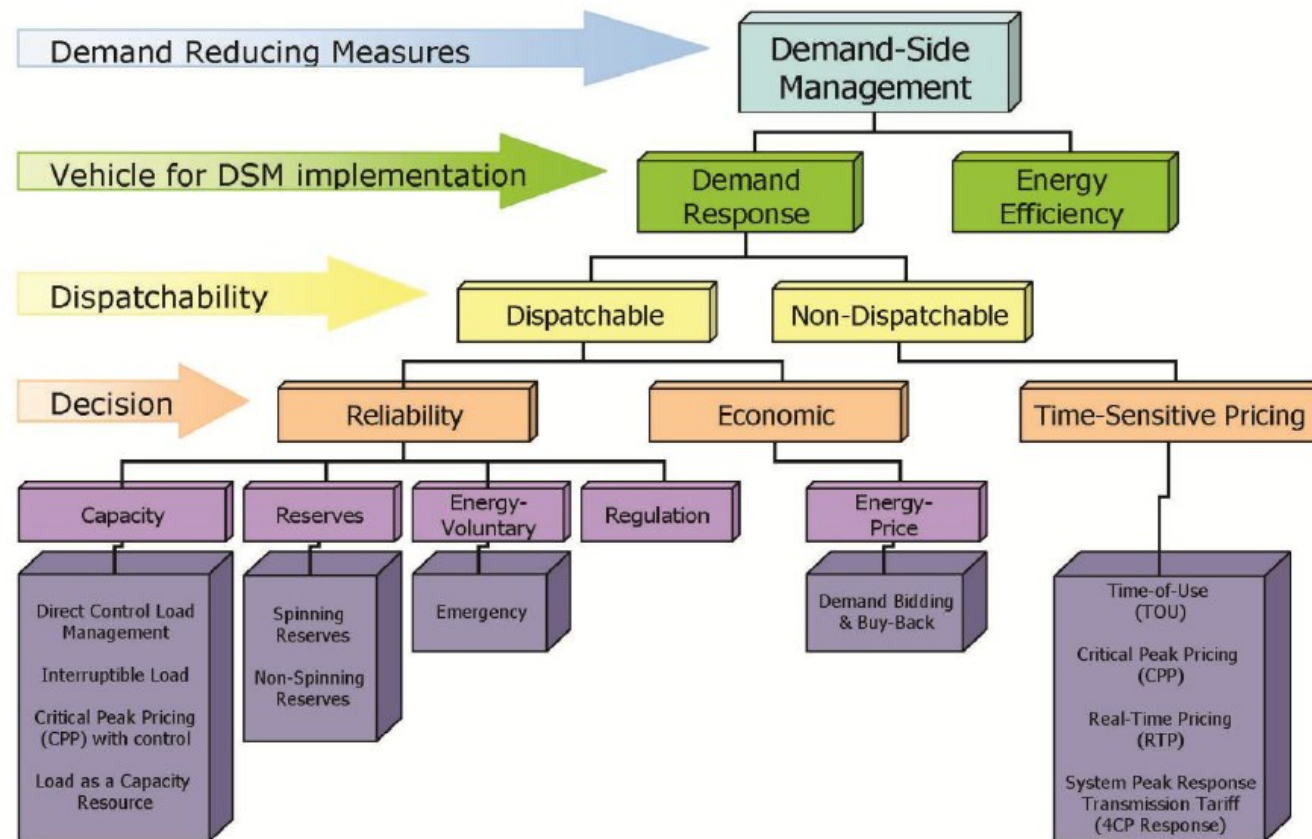
Tariffs doesn't accurately reflect costs:

- Absence of retail competition.
- Absence of short-term markets
 - Weak locational signal

Incipient regulatory provisions

DR and EE should be the result of a clear government policy

DEMAND SIDE MANAGEMENT IN A NUTSHELL



Source: NERC 2011

DEMAND RESPONSE (DR) IN BRAZIL AS A RESOURCE

Potential for becoming a cost-effective source of flexibility in the short, medium and long-term for the system

IN BRAZIL:



Time Of Use Tariffs
(ToU)

Interruptible
Contracts (Past)

Tariff Flags (Low Voltage)

Blue and Green Flags (High Voltage)

White Tariffs:

Voluntary adhesion

Requires smart meter



Who will be the contracting party of
DR programs?



How will the provider be
remunerated?

PRICE - BASED DEMAND RESPONSE

(TOU, CPP, RTP) >>>

Does not require the load to be verifiable.

Dynamic Pricing (CPP, RTP):

Trade-off: more accurate prices

Pilot programs

technological constraints

institutional constraints (absence of spot prices reflecting short-run marginal costs on a real-time basis).

Complexity, higher transaction costs

Efficiency



How reliable it is as a dispatchable load?



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Pilot programs tailored to critical areas?

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ALTERNATIVES FOR DR

INCENTIVE-BASED



Demand-side bidding, interruptible demand, and direct load

More fit to deal with sudden contingencies.

How to define the value of reduction?

EFFECTIVENESS



Rate of adhesion policy

Complementary technologies

Market mechanisms

Consumer engagement

THE NEED OF A NEW REGULATORY FRAMEWORK TO LAUNCH DEMAND RESPONSE AS A RESOURCE

Need for new Business Models

Competition and new players in retail.

Requires the provision of comparable (to generation) opportunity

More accurate price signals

Aggregators:

- Transaction costs (specially for small consumers).
- Customer interface management.
- Portfolio of residential consumers has increased value

Enablers: technology.

Access to markets

Compensation

DERs AND SYSTEM OPERATORS

A massive deployment of DERs brings further challenge for System Operators

Managing two-way flows

Real time information and communication with the power plants and demand resources

The planning and operation's efficiency of the ISO or Disco relies on controlling the majority of the loads.

Long-term horizon planning is more challenging but...

If the operator efficiently incorporate these resources, it increases the system reliability at lower costs

ICTs and the huge amount of data to be generated

Access

Technical expertise

Privacy and security issues: should be addressed in advance to mitigate further uncertainty

THE BRAZILIAN EXPERIENCE WITH ENERGY EFFICIENCY

Slower response

Not dispatchable

Longer effect

Powerful Resource

In Brazil
“top-
down”
policy:

PROCEL

Energy Efficiency Program:
mandated investments by
DISTCOMs

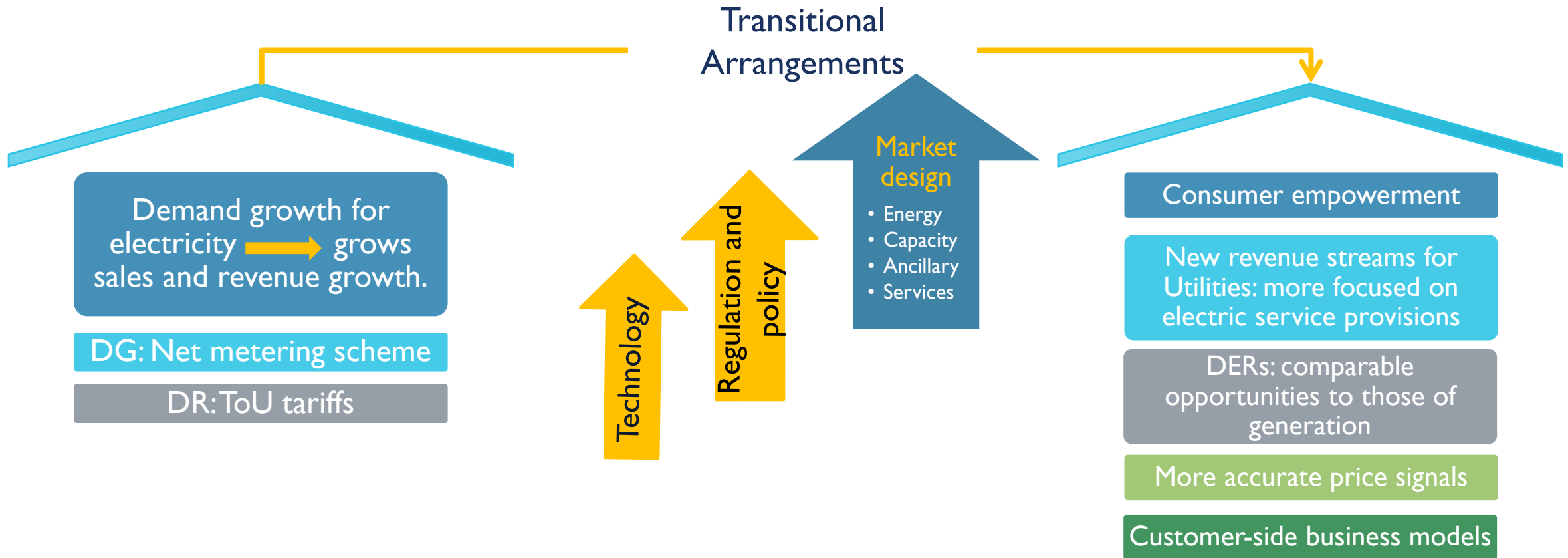
- Public procurement
- 20% for Procel

Areas for improvement – third party certification,
governance of Procel investments

Other policy options: Standard Offers (South
Africa), White Certificates (Mexico)

Longer-term: auction of EE as an energy supply
option in forward Markets. (e.g. Neepee)

OUR APPROACH



GOVERNANCE OF THE TRANSITION

Challenge: disruptive changes, pace of technology innovation, a new paradigm.

A dynamic framework for assessing priorities and recommendations, and acting on them to provide a sound regulatory and competitive environment must be drawn.

Requires a comprehensive and integrated strategy

- active engagement of external stakeholders.
- interagency dialogue

The executive power: leadership role in orchestrating the interaction of multiple stakeholders


- Acknowledge all stakeholders as strategic players.

Integrated view of short, intermediate, and long-term objectives involving various actors and sectors.

Aneel “Chamada 20” R&D is an important step in this direction – necessary but not sufficient.

Quadriennial Energy Review (QER): An interagency Task Force, which includes members from all relevant executive departments and agencies (agencies) to develop an integrated review of energy policy that integrates all of these perspectives.


CONCLUDING REMARKS (1/2)



DERs can play an important role in the adequacy and reliability of the power system



DSM/DR are already consolidated in many countries while DG is in state of flux, BUT in both cases important lessons can be learned



There is some experience in Brazil on Time of Use Rates. At the same time there is an uncharted territory

CONCLUDING REMARKS (2/2)



Regulation should embrace DERs

By setting clear, transparent and consistent political targets across time and policies

Sound financing mechanisms should be available and risk factors understood.



Grant provisions for load aggregators (demand and generation)



Competition in retail market welcomes innovative BMs. More accuracy for price signals of the value of electricity.



THANK YOU!

