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4 waves of innovative Regulation… An update

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(with Pradyumna Bhagwat & Swetha RaviKumar Bhagwat)

IIT Kanpur – Center for Energy Regulation

4 March 2021

I was with you in October 2018, I am back

Back for an update…

-- -- -- -- Introduction: The 2 classics of Regulation-- -- -- --

- 1- Universal Access, Monopoly & Cost of Service
- 2- Opening Commodity Markets & Incentive Regulation

-- -- -- -- Body of today's update-- -- -- --

- 1- (Incentive Regulation + Innovation) = RIIO
- 2- The "Coupling Regulation" & Sector Integration
- 3- The "Dynamic Regulation" called by "Prosumer" revolution
- 4- The "3D Dynamic Regulation"called by Digital interactions in a multi-level system

> You can ask Praduymna & Swetha an adaptation to India's realities


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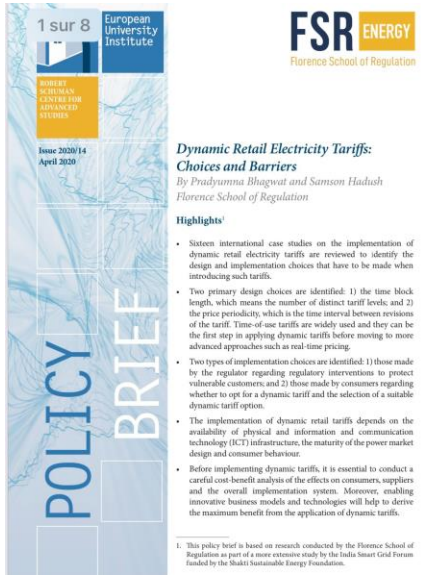
Charging up India's Electric Vehicles
By Pradyumna Bhagwat, Samson Yemane Hadush, Swetha Ravi Kumar Bhagwat
Florence School of Regulation
Issue 2019/15
October 2019
POLICY BRIEF
Highlights
• India's ambitious electric mobility targets are highly dependent on the availability of robust charging infrastructure and readiness of the power system to integrate the additional flexible EV load.
• Indian policymakers at state and national level are proactively pursuing actions for developing EV charging infrastructure (EV service providers) on supply-side and EV users' (demand side). Further enhancements for supply-side can come from the role of distribution companies (DISCOMs), tariff design, incentives, permitting processes and data privacy, and on the demand side from payment methods, minimum facilities, charging station user registration and consumer complaints.
• EV charging business in India is at its early stage, and it has a large scope for business model innovation. As EV penetration increases and market grows, innovations can be expected in the areas of service provision, partnership and pricing.
• EV load can increase peak demand and distribution grid congestion. Solutions are emerging to avoid more investment in generation and network capacity such as time-varying tariff and flexibility measures taken by the DISCOM to deal with these issues.
• V2X is still in an early stage but would become relevant as the market matures. The accuracy in predicting the availability of V2X resource and minimising market entry barriers for V2X service provision can be improved through aggregation, allowing smaller minimum bid volumes and contract periods, asymmetric products and shorter lead times.
• The search for the most appropriate solutions would benefit from regulatory sandboxes both at the national and state level.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Issue 2020/14
April 2020
POLICY BRIEF
Dynamic Retail Electricity Tariffs: Choices and Barriers
By Pradyumna Bhagwat and Samson Hadush
Florence School of Regulation
Highlights[1]
• Sixteen international case studies on the implementation of dynamic retail electricity tariffs are reviewed to identify the design and implementation choices that have to be made when introducing such tariffs.
• Two primary design choices are identified: 1) the time block length, which means the number of distinct tariff levels; and 2) the price periodicity, which is the time interval between revisions of the tariff. Time-of-use tariffs are widely used and they can be the first step in applying dynamic tariffs before moving to more advanced approaches such as real-time pricing.
• Two types of implementation choices are identified: 1) those made by the regulator regarding regulatory interventions to protect vulnerable customers; and 2) those made by consumers regarding whether to opt for a dynamic tariff and the selection of a suitable dynamic tariff option.
• The implementation of dynamic retail tariffs depends on the availability of physical and information and communication technology (ICT) infrastructure, the maturity of the power market design and consumer behaviour.
• Before implementing dynamic tariffs, it is essential to conduct a careful cost-benefit analysis of the effects on consumers, suppliers and the overall implementation system. Moreover, enabling innovative business models and technologies will help to derive the maximum benefit from the application of dynamic tariffs.
1. This policy brief is based on research conducted by the Florence School of Regulation as part of a more extensive study by the India Smart Grid Forum funded by the Shakti Sustainable Energy Foundation.


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REPORT
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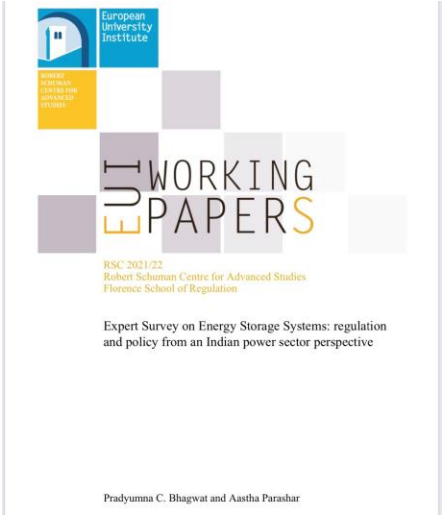
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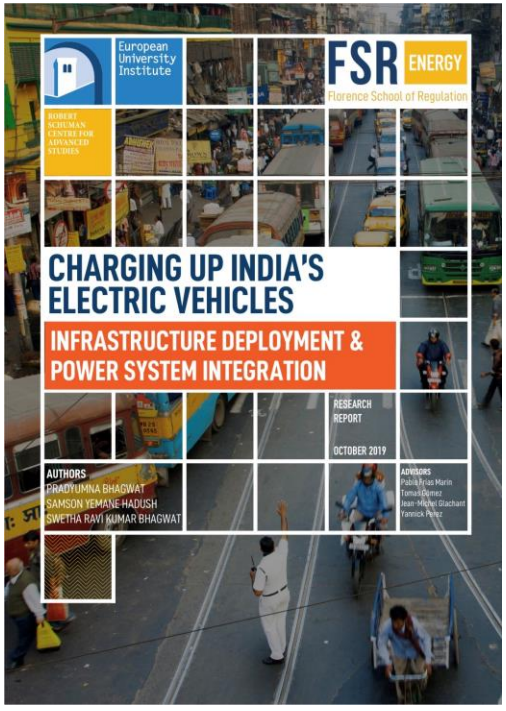
Robert Schuman Centre for Advanced Studies
Florence School of Regulation
Expert Survey on Energy Storage Systems: regulation and policy from an Indian power sector perspective
Pradyumna C. Bhagwat and Aastha Parashar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CHARGING UP INDIA'S ELECTRIC VEHICLES
INFRASTRUCTURE DEPLOYMENT & POWER SYSTEM INTEGRATION
RESEARCH REPORT
OCTOBER 2019
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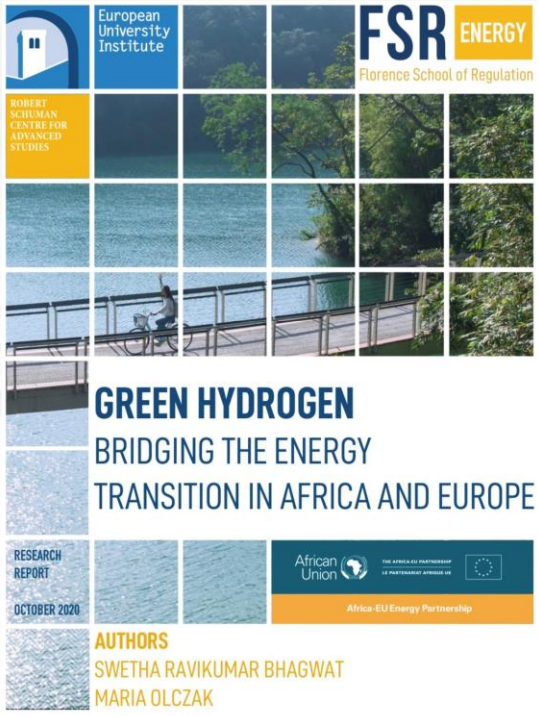
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GREEN HYDROGEN
BRIDGING THE ENERGY TRANSITION IN AFRICA AND EUROPE
RESEARCH REPORT
OCTOBER 2020
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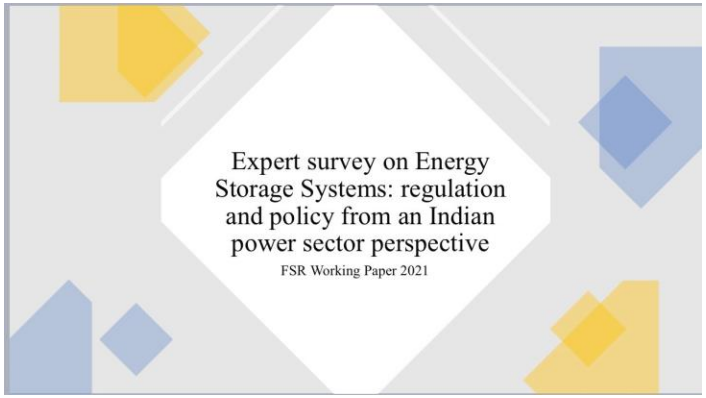

Expert survey on Energy Storage Systems: regulation and policy from an Indian power sector perspective
FSR Working Paper 2021

Introduction: the two classics of Regulation

Classic 1: Universal Access, Monopoly & Cost of Service

- Society wants to give access to modern energy (electricity) to many or to all
- Electricity is delivered by monopoly grids connecting crowds of consumers to very large size generators (in the 100' of MW)
- Monopoly access to generation permits to lower energy affordability, with cross-subsidizing tariffs
- Vertical integration "Monopoly Access + Energy Generation" is regulated with "Cost of Service"

Introduction: second classic of Regulation

Classic 2: Opening Commodity Markets & Incentive Regulation

- Total size of system is x times the size of single efficient generator; total size consumption is x times the size of single efficient supplier > > Room to create open markets

- Markets for professionals: B2B – wholesale market; Markets for non-professionals: B2C – retail markets >> B2B Energy is priced as a commodity; but Cross-subsidies can survive in Tariffs

- Incentive Regulation tools

Price Cap for Opex (**RoR** for Capex): decrease of Opex shared between company & society

Performance Based Regulation (for losses, congestion costs, balancing costs): performance better than targets = extra reward; worse = punishment

Menu of Contracts (sophisticated alternatives to Price Cap + PBR) extra performances give defined extra rewards but without minimum revenues if Bad Perf (= extra risk; kind of generalized PBR)

Yardstick Competition (the relative performances of all the regulated gives rewards & punishments) – kind of mandatory "Menu of Contracts"for all, where contract is set by the "best of class"

Update1: Incentive Regulation + Innovation

Incentive Regulation assumed that companies innovate on their own

It is why Opex is lowered, Performances increased, More risky contracts taken in Menu, etc.

10 years ago, it became clear that innovation had to accelerate (smart grids, smart metering) and had to enter incentive regulation everywhere >> RIIO *"Revenues = Incentives + Innovation + Outputs"*

- **New Tools**
- **Innovation is to face the unknown, take risks, do trials & errors. Regulator has to be lenient: return to 'cost of service' for testing & experiences; grants for innovators; increased ROR for Capex uncertainty**
- **"Sandboxing": the companies learn; the regulator too. With more knowledge, innovation can marry better with 'classic' incentives**

Update1: Incentive Regulation + Innovation

- Classic Tools are revisited for innovation

*If innovation lowers the costs, it enters Price Cap; Capex too can enter Price Cap: TOTEX substitutes to (Opex Price Cap + RoR for Capex)

> decrease of TOTEX shared between company & society

**If innovation increases performances that can be measured; Performance Based Regulation

For ex: renewables capacity hosted by the grid: performance better than targets = extra reward; worse = punishment

***If innovation requires strong skills: Menu of Contracts Only people with strong skills will take more rewarding / more risky contract

For Ex. UK offshore sea grids; generators can define & build if they want; reselling sea grid assets & franchise in auctions before normal offshore operation

Update2: “Coupling Regulation” & Sector Integration

Just seen that “Incentive Regulation + Innovation” can create structural changes like “new modules of regulation” separated from the general regime of regulation (UK: the Offshore transmission sea grids)

Many other cases of “new regulatory modules / local regulatory regimes” like:

Rural microgrids, minigrids to give access to electricity

Auctions for utility-scale solar parks or wind farms with FiT

Local storage for grids to balance RES intermittency

Planning of charging stations for EVs & El.bikes

Creation of city gas infrastructures to decrease local air pollution

Green Hydrogen industrial valleys

All these new modules de-integrate the regulatory frame; create particular regimes for their own classes of infrastructure assets or technological systems.

Update2: “Coupling Regulation” & Sector Integration

However these new modules end up articulating with the general regulatory frame in a 4 step process

Step 1- Rolling out of the new infrastructure or infant technical system, with its particular set of rules

Step 2- At a maturity point; decision if (Unbundling) & (nomination of a regulated operator) is needed

Step 3- Definition of a maturity regime: (Code of operation of the infrastructure or system)< < Alignment >> (Rules of Market Design; maybe with market operator)

Step 4- This modular maturity regime evolves with successive realignments of the pair { infrastructure operation code & rules of market design} to operate smoothly with the same pair from general regime of regulation

= “Coupling the Regulatory Regimes”

to get general “Sector Integration”

Update3 "*Dynamic Regulation*": the Prosumer Revolution

"Innovation" can create structural changes with "new modules of regulation". NOW: one single structural change can transform the entire landscape of regulation…

Classics of regulation (Monopoly + Costs of service) & (Markets + Incentive regulation) were both assuming that consumers need a grid access to get served.

The Prosumer breaks that by investing into self-generation, self-consumption, self-storage, self-management of individual load

Any decision by the regulator, or the regulated operator, is followed by prosumers' adjustments: in their behaviour & assets portfolio management, + new decisions to become prosumer.

Update3 "Dynamic Regulation": the Prosumer Revolution

Regulator or Regulated Operator cannot assume that their alignments - just seen in Update2

[[(Code of operation of the infrastructure or technical system)< < Alignment >> (Rules of Market Design; maybe with market operator)]]

will work as they would like

Prosumer Revolution: the whole regulatory regime has to evolve - with successive realignments of its pair { infrastructure operation code & rules of market design} to respond to decisions taken by active prosumers

"Dynamic Regulation" = continuously coupling the "Regulatory Regimes" with new reactions / new decisions from Prosumers

Update4 "3D Dynamic Regulation": Digital interactions in a multilevel system

The idea of "dynamic regulation" assumes that there is a new player (the prosumer) which has enough incentives and liberty of decision-making to always react to decisions taken by the regulator or regulated operators.

The "3D Dynamic Regulation" is the new system we are entering in.

The whole electricity system is incredibly changing, in all its dimensions: 3D.

From the top to the bottom, within its frontiers, as behind its frontiers.

"3D Dynamic Regulation" = continuously coupling the "Regulatory Regimes" with novelties popping anywhere…

Update4 "3D Dynamic Regulation": in a multilevel system

Distributed energy resources, self-generation & self-consumption, self-storage, demand response, charging electric vehicles, etc. are managed with decisions taken "beyond electricity regulation" and "behind the meter"…

The whole electricity system was made of Transmission & Distribution encapsulating Generation.

A new level of the electricity system appears: the individual decisions taken "BthM"

"3D Dynamic Regulation" = the electricity system is become multilevel… not anymore controlled by a single system operator & the central dispatch…

Update4 "3D Dynamic Regulation": Digital interactions

Electricity system is not only become "Multilevel"; it is become "digitally interactive" in all its dimensions

Digitalisation continuously enabling new players, permitting new products, favouring new types of trade arrangements: towards 5G & Internet of Things

New Players

Aggregators, prosumers, energy communities, asset fleet managers, platforms

New products

Green energy, chained generator, storage, charging EV, flexibility, load management

New Trade arrangements

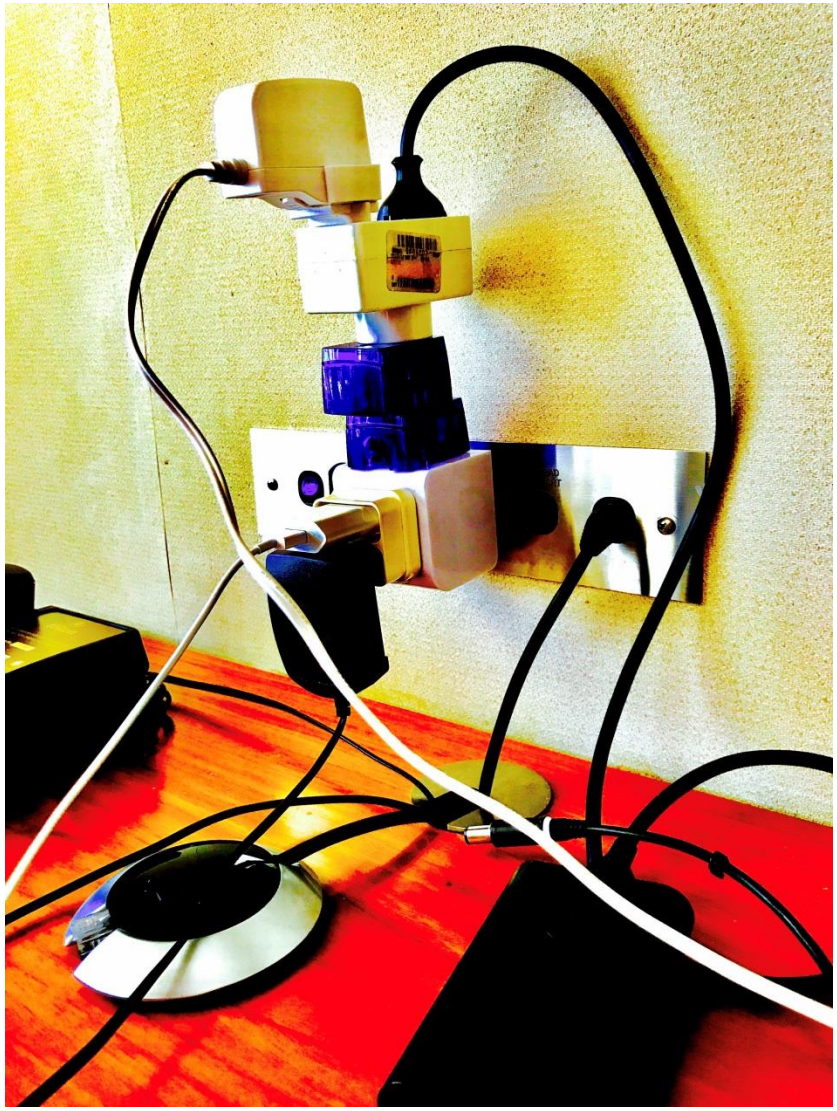
C2B, C2C (Peer2Peer – Blockchain), two-sided Markets

"3D Dynamic Regulation": Digital interactions in a multilevel system

We still have to align (operation of Infrastructures & Technical Systems) with (rules of Market Design) but…

	Infrastructures & Technical Systems		
	TRSM level -	DSTRB level -	BthM level
Market Designs			
B2B			
B2C			
C2B			
C2C			

Multilevel Regulation & Digitally interactive



Multilevel Regulation & Digitally interactive

Conclusions: a lot of challenges for regulation, and regulators

<:> <u>New Incentive Regulation</u>

to favour structural business innovations

Innovative Business Models to come <through> "Modular Regulatory Regimes" + Their "Coupling"

<:> <u>New Dynamic Regulation</u>

Beyond "Utilility regulation" with New Players, New Products, New Trade Arrangements, with growing "Behind the Meter" activities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