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4 waves of Regulation's... challenges & tools...

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To stay young... for ever!



Regulation: a Lego to play...

- -- -- -- -- Two Big Classics of Public Regulation -- -- -- --
- **1st Layer:** To submit (Natural Monopolies) to Social Welfare
- **2nd Layer:** To implement Political Economy of (Universal Service)
- -- -- -- -- Two Revolutions of Public Regulation:
Industry Structure, Technology, Market Arrangements -- -- -- --
- **3rd Layer:** To coordinate (Unbundled Grids) & (Market Design)
- **4th Layer:** To innovate with (Decentralization) + (Digitalization)

Regulation: a Lego to play...

- **1st Layer:** To submit (Natural Monopolies) to Social Welfare
- -- -- -- -- 1880' & 1900' (Railways) -- -- -- -- 1930'&40' (Electricity)
- **2nd Layer:** To implement Political Economy of (Universal Service)
- -- -- -- -- **Two Revolutions of Public Regulation:**
Industry Structure, Technology, Market Arrangements -- -- -- --
- -- -- -- -- 1980' & 1990'
- **3rd Layer:** To coordinate (Unbundled Grids) & (Market Design)
- -- -- -- -- 2010'
- **4th Layer:** To innovate with (Decentralization) + (Digitalization)

Regulation: a Lego to play...

- **1st Layer: Social Welfare with natural monopolies**

1- Monopoly of essential facility: as a bridge on a river.

2- Utility for society is usage, then pricing. Monopoly price not good for society.

3- Society will price better: fair price for owner & fair price for users.

Average Price? Marginal Price? Recovery of Fixed costs? >>

Regulated cost of service.

France Railways: discrimination pricing. 1 price for flowers; 1 price for coal. 1 price for 3d Class, for 2nd Class, for 1st Class

Regulation: a Lego to play...

- **2nd Layer: Political Economy of Universal Service**

- 1- Investments: where to put bridges & rails? > *Universal Service*
- 2- Price discrimination: why to discriminate? > *Postal Stamp*
- 3- Postal stamp is average pricing > *Social tariffs*
- 4- Quality of service: why to discriminate? > *Universal Quality*
- 5- *Further Technology choice & innovation >How compatible with Universal Service & Postal Stamp?*

Regulation: a Lego to play...

- **3rd Layer: Coordinating (Unbundled Grids) & (Market Design)**

1- To do Unbundling “*Infrastructure facility*” from “*Final services*”

➤ Unbundled grids (~ / ~) > Independent Market

2- To do Unbundling “*Regulation*” from “*Political economy*”

➤ Independent regulators (~ / ~)

3- Then one can go to “*Incentive Regulation*”

➤ and faced its “*seams*”: the ***coordination issue***.

What's coordination issue?

“Essential facility / Final service”

My hotel room in Australia: Access is not only pricing > *Transaction Costs*

Lovely 😊 Aussie 😊 plugs... seen by a continental EU visitor



What's coordination issue?
“Essential facility / Final service”

My hotel room in Washington:
Access is not only pricing >
Transaction Costs

Lovely 😊 NorteAmericana 😊
plugs... seen by a continental
EU visitor



What's coordination issue?

“Essential facility / Final service”

My hotel room in New Delhi:

Access is not only pricing >

Transaction Costs

**Lovely 😊 NorteAmericana 😊
plugs... seen by a continental
EU visitor**

Regulation: a Lego to play...

- **3rd Layer: Coordinating (Unbundled Grids) & (Market Design)**

3- We did go to “*Incentive Regulation*”, and faced its “*seams*”

4- Rules for Infrastructures interact with “Market for final services” via “**System Operation**” > *Grid Codes (Capacity calc. & allocation, Congestion man., Balancing)*

5- “System operation neutrality” is “market design” sensitive: “Zonal” vs “Nodal

6- Revenge of Ronald Coase & Oliver Williamson: Markets need “infrastructures for transaction”- Market Transaction <**calls for**> Industry Coordination

7- Regulation still needed BUT very far from ‘Natural Monopoly Pricing’ + ‘Universal Service’ > another type of rules needed

> Need regulation to make market work on the basis of “system operation”.

In the EU >> EU Market Design is implemented via Network Codes

Regulation: a Lego to play...

- **4th Layer: Innovating with two Big Bangs (Decentralization) + (Digitalization)**

1- Decentralizing “Big Bang”.

New Generation technology shift: (**1st**: French nuclear plant 1,700MW - Coal Plant 500/1,000MW - CCGT 300MW) ~/~ (**2nd**: Wind mills by MW - PV Panels by KW)

This can be pushed by decarbonisation (new public policy) > (new kind of Regulation): EU, Maryland, California. Or not: State of Texas, Chile, Mexico. Etc.

“Utility Wind & Solar” becoming very cheap, can beat coal: India; or gas: US

(And more to come: V. Sivaram -2018- *Taming the Sun. Innovations to Harness Solar Energy & Power the Planet*)

Consumption technology shift: Aggregation. Multiple small consumption units are gathered, & become new offer which enters wholesale market as “virtual units”

Storage revolution (in between) started, growing, challenging system operation

2- Digitalization is parallel “Big Bang”.

1st wave digitalization (“mainframes”, smart meters) supported wholesale market

2nd wave digitalization (+ new smart grids) supports new decentralization shift

(S. Vadari -2018- *Smart Grid Redefined. Transformation of the Electric Utility*)

Why Decentralization & Digitalization are twins...

1/ Decentralization changes size & scope of assets;
then their operation, & the decision making

New Ownership structure <:> New Operation rules for assets <:> New
Governance structure for industry

2/ Digitalization changes information, control, & decision making;
then operation of assets, services they deliver > new decision making:

New Technology frame <:Information, Control, & Decision Making:>
New Operation Rules & New Services <:> New Governance structure

1/ Decentralization brings two children

*End of single centralized Utilities; substituting multiple players

**End of single centralized System Operation; substituting multiple levels of control & optimization

2/ Digitalization brings two children

*Setting rules outside traditional Electricity Sector regulation (as Aggregators playing with “Behind the Meter”)

**Coordination of new ‘digitalized’ tasks within Electricity Delivery Loop

>Remember 1st wave: Coordinating Transmission & Wholesale

>2nd wave > Amazon “Delivery Loop”

= the “Distribution Grid Platform”

which is where *prosumers* + *prosumagers* + all other *Behind the Meter* enter the El.system

1/ Decentralization has two focal points

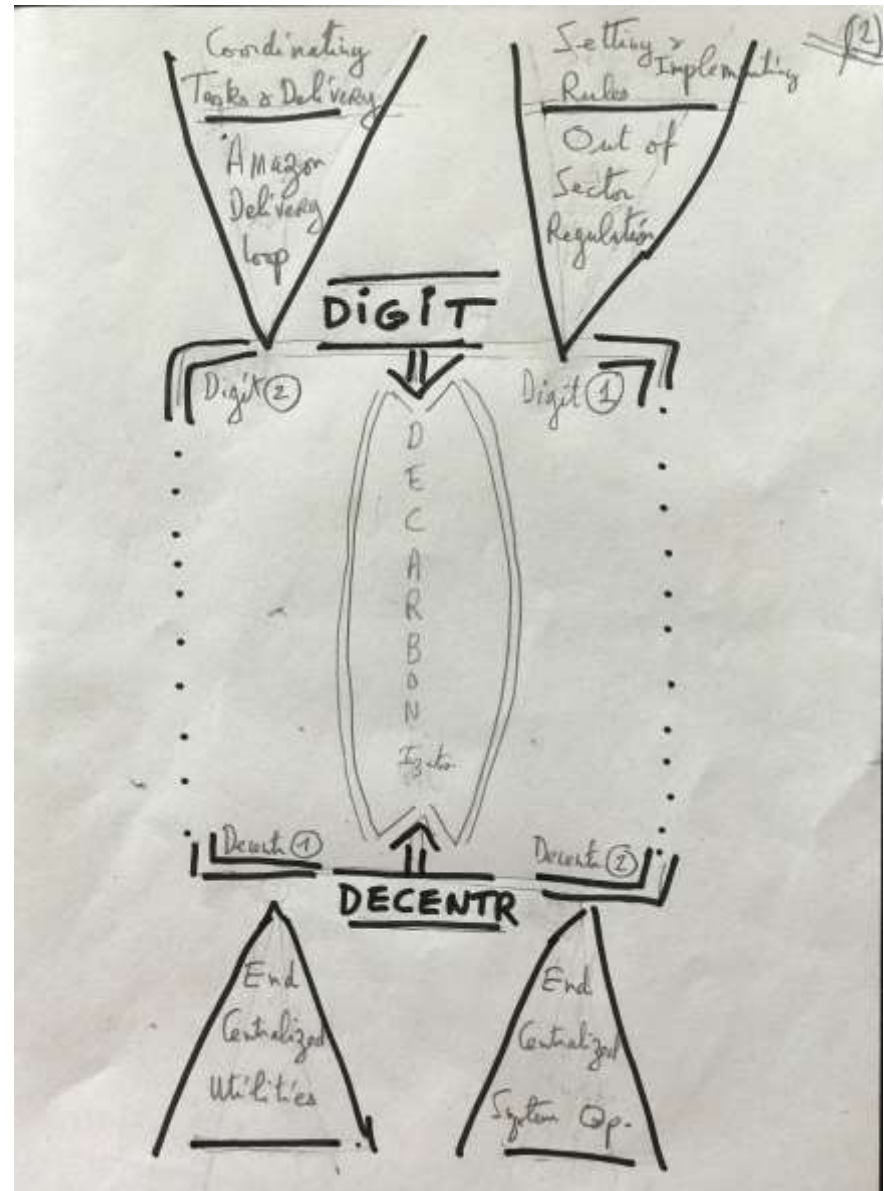
*Ending centralized Utilities

**Ending centralized System Operation

2/ Digitalization has two focal points

*Setting rules outside El. Sector regulation

**Coordinating digital tasks with El. Delivery loop (Amazon "Delivery Loop" = Distribution Grid Platform)



Interactions between twins: Decentralization - Digitalization

Decentralization opens two streams of changes

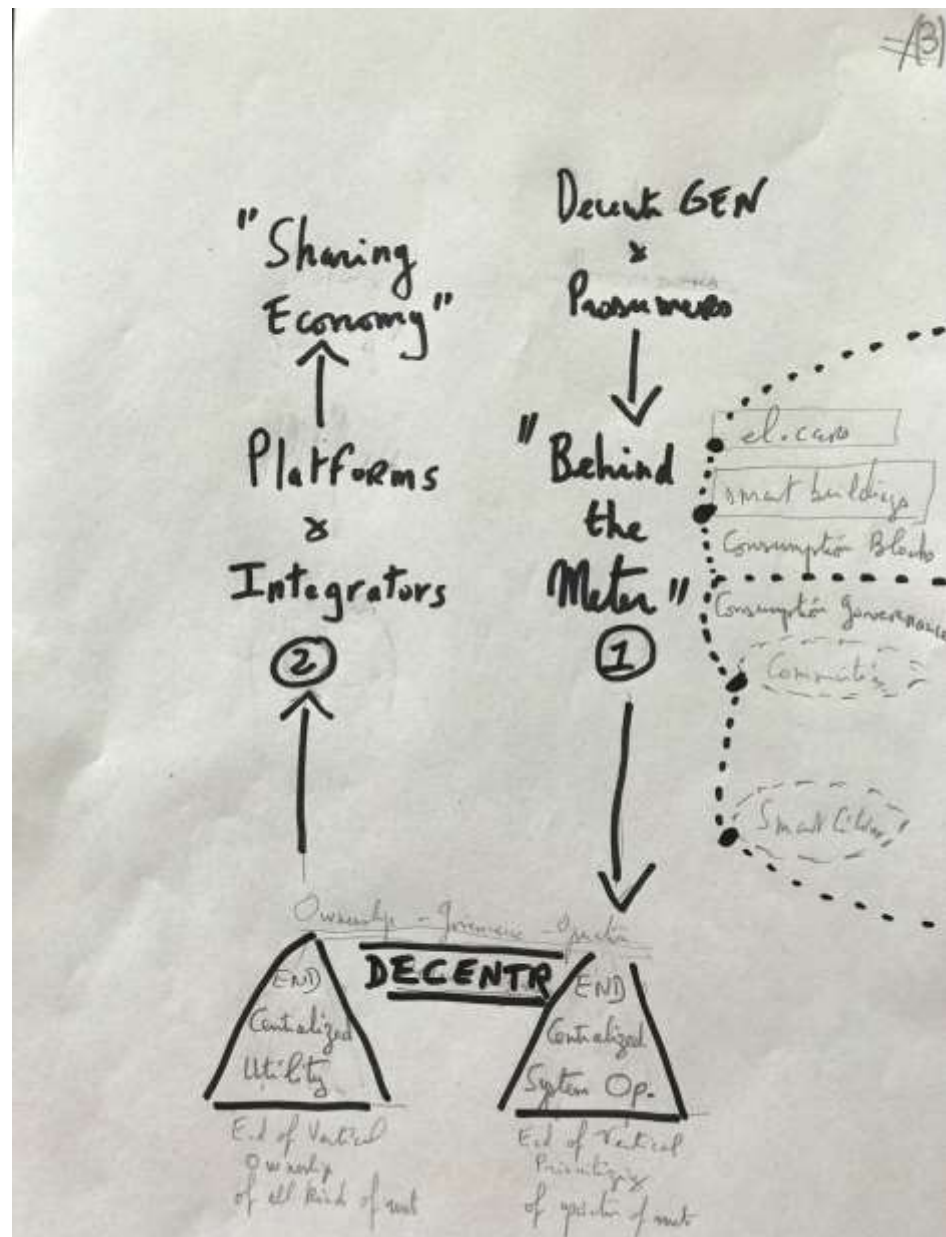
1* **Distributed Generation** expands,
with new “**Utility Scale Renewables**”,
down to distributed **Prosumers** (PV or Wind PPAs), **Prosumagers** (Storage),
& other “**Behind the Meter**” (electric Cars; smart buildings)

2* **Aggregators & Platforms (2-sided markets)**
offer new ways of coordinating decentralized units
(Down to “**Sharing Economy**” Platforms = **Peer2Peer**)

Decentralization supports two streams of changes

1* **Distributed Generation** expands to distributed **Prosumers** (PV or Wind PPAs), **Prosumagers** (Storage), & more "**Behind the Meter**" (electric Cars; smart buildings)

2* **Platforms & Integrators** offer new ways of coordinating the decentralized units, down to "**Sharing Economy**"
Platforms (**P2P**)



Digitalization favors two streams of changes

1/ **Playing from outside Traditional Sector:**

Fleets of “*Behind the Meter* devices” can be gathered & controlled to be managed as system smart assets

(think electric car fleets; or “*zero net consumption*” buildings)

2/ **New ways of coordinating decentralized units,**

thanks to Agregators & Platforms **P2P**;

down to **Blockchain** networks (a Blockchain network is **P2P** with NO intermediary, with NO UBER between Peer-2-Peer).

3/ **BUT WITHIN** “**Amazon Delivery Loop**” constraint

It is the needed / desired “Distribution Grid Platform”

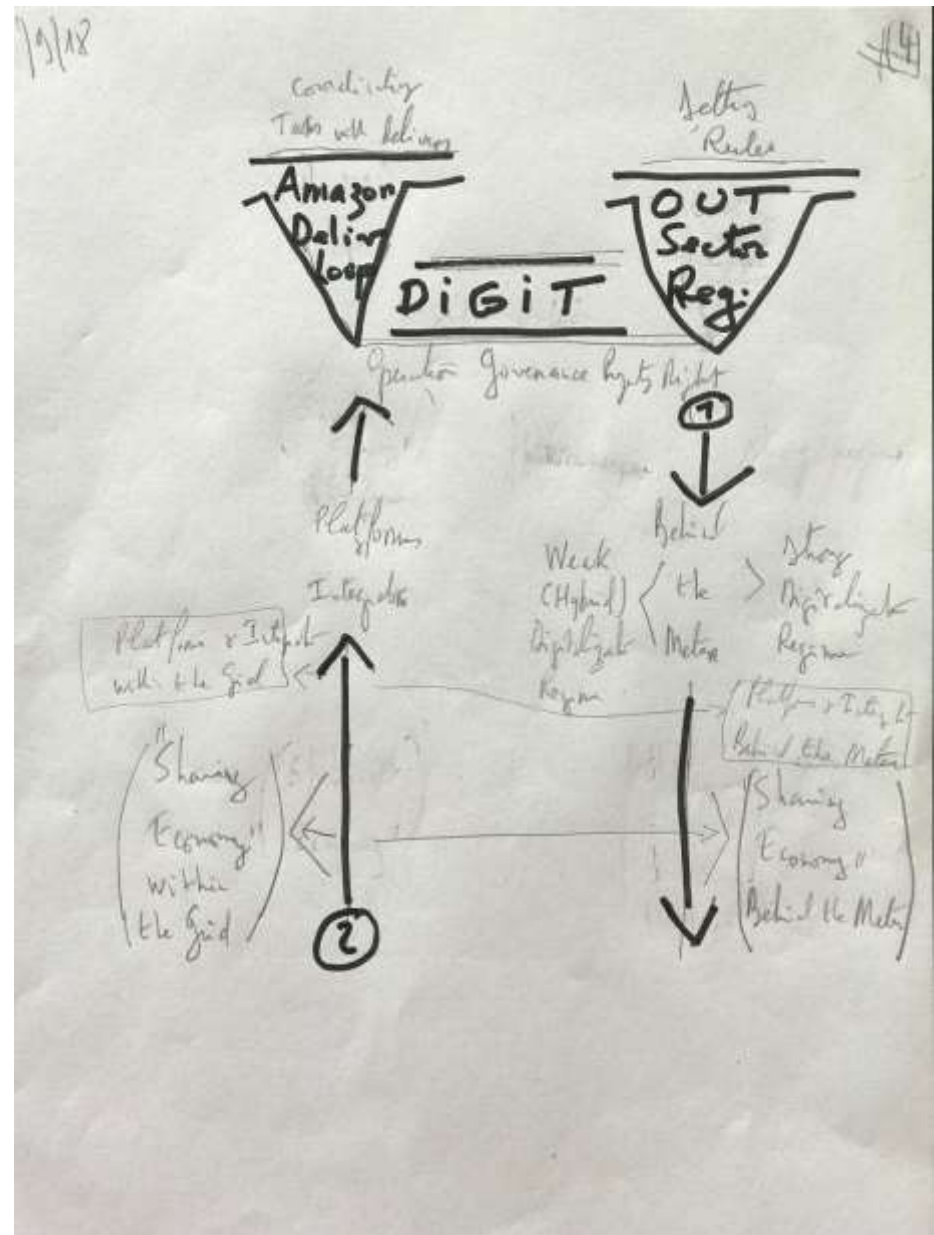
– the Ignacio Perez-Arriaga “**Utility of the Future**” when perfectly set up (MIT Report 2016); or New York “**Distribution Platform**” project (Sioshansi Fereidoon 2017; 2019)

Digitalization favours two streams of changes

***Out of Sector** gathering the “Behind the Meter devices” to manage them as smart assets (think electric car fleets)

****Agregators & Platforms** offer new ways of coordinating the decentralized, Down to Blockchain networks (NO intermediary, NO UBER between Peer2Peer)

***But “**Amazon Delivery Loop**” constraint (*Distribution Grid Platform*)



Decentralization & Digitalization strongly interact

1/ Because they have similar streams of changes

>* **“Behind the Meter”** targets of “smart assets”

>>** **Aggregators & Platforms P2P** offering entry to the **“El. Amazon Loop”**
delivery constraint

2/ Both 2Ds (Decentralization & Digitalization)

touch upon tasks, assets, operation, apps, integrators, platforms

>> **Up to Governance**

with new types of players, as

*Communities of Peers

**Clubs of Partners

***Smart Local Authorities

Decentralization & Digitalization strongly interact

Because they have two similar streams of changes

*The “**Behind the Meter**” targets of smart assets

**Platforms & Integrators

facing the “**El. Amazon Loop**” delivery constraint

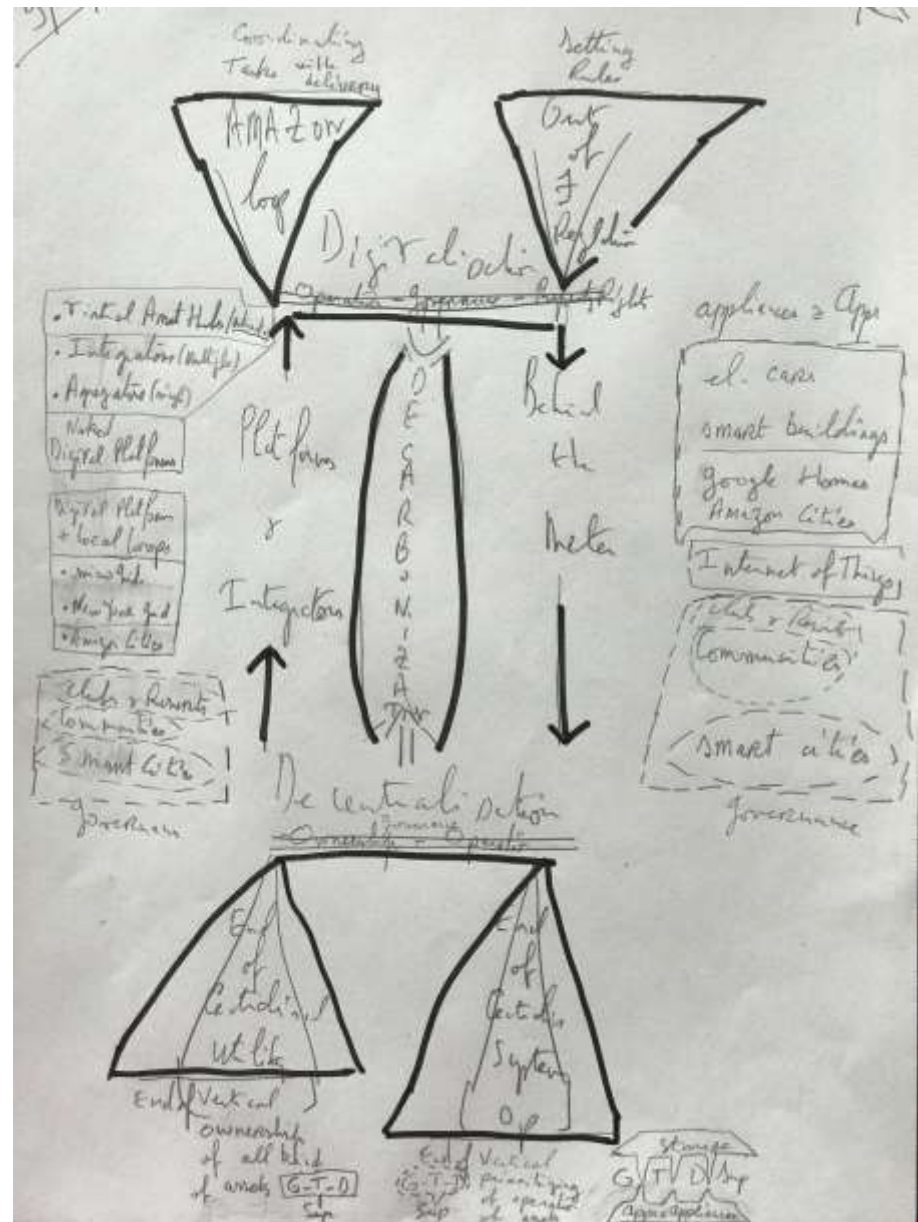
They touch upon tasks, assets, operation, apps, integrators, platforms

>> **Up to Governance:**

*Communities of Peers

**Clubs of Partners

***Smart Local Authorities



3/ Conclusions: a lot of challenges for industry, industry regulation, and regulators

<:> New Coordination Tasks

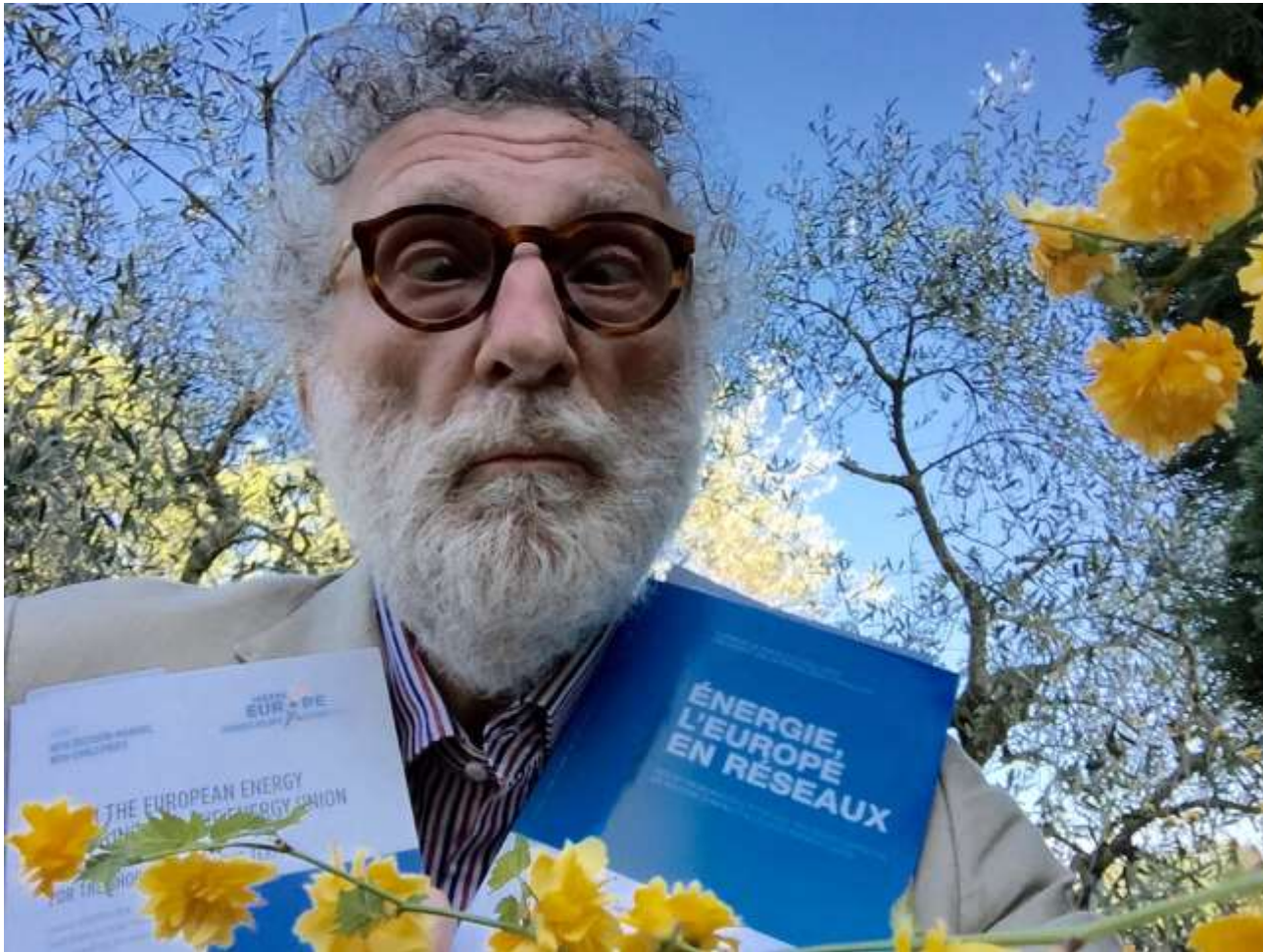
Beyond “Utility regulation”

+ “Behind the Meter” activities

<:> New Incentive Regulation:

needed to favour structural business innovations

Innovation Business Models <through> Regulatory Frames



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