

**LATAM hunting for the next
milestone in the renewable
energy transformation Part 2.**



**Energy Transition: the cases
of Argentina, Bolivia, and
Colombia**

Energy transformation in Colombia

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Agenda

- At the outset. Progress during 2000-2019.
- Progress and commitments 2019-2021
- What does the future look like - 2030
- Final thoughts

At the outset: 2000-2019

Very little progress during the first 20 years of this century.

- Law 691, 2001 that was implemented in 2003. Ration energy use and the promotion of renewables. Not much!
- Jeparachy (2004), the first wind farm in Colombia, 20MW; benefited from green bonds and little from science and technology funds.
- Law 1715 (2014) still being implemented!!!
- No other significant project until after 2019 in spite of Law 1715
- Much progress?

Lessons from deregulation in Colombia: successes, failures and the way ahead

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“Colombia has done well on price, reliability and quality but still has major problems trying to legitimize the whole system, implement a sustainable (and fair) price system, improve the wholesale market framework, and develop a proper market for household customers, i.e. fully develop retail competition. If no progress is made with respect to these and similar issues, Colombia might end up worse off than Chile, Brazil and California.”

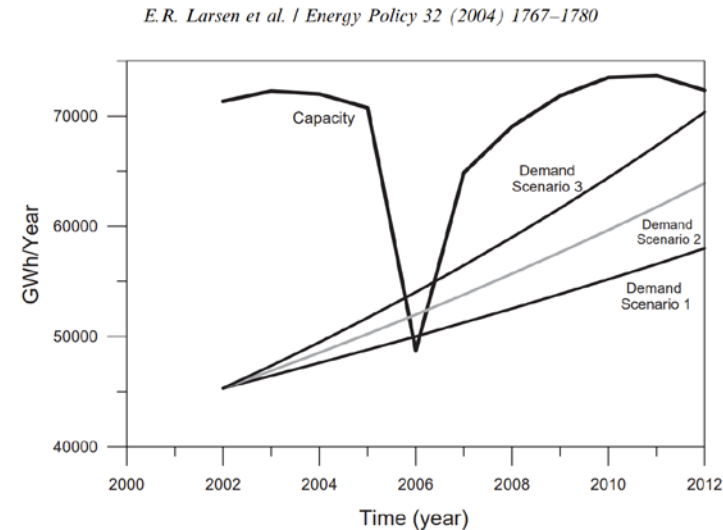


Fig. 10. Simulation of the consequence of an intense Niño on supply availability and electricity demand.

Incentives for renewable energy in reformed Latin-American electricity markets: the Colombian case

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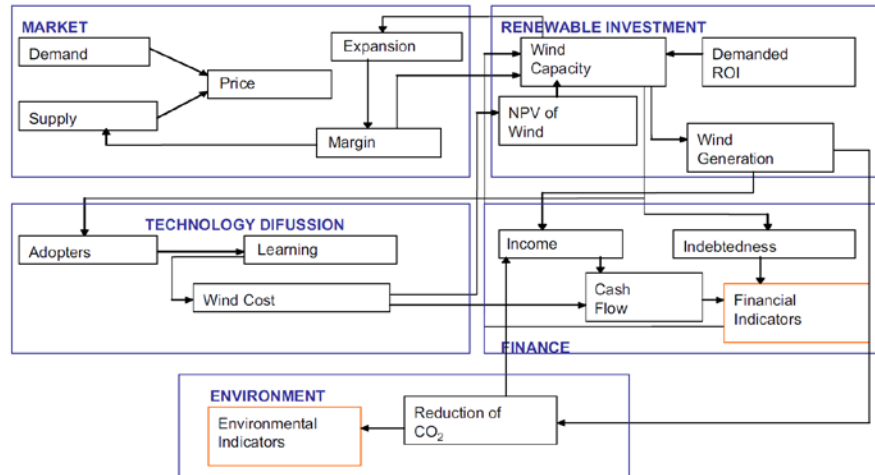


Fig. 6. Dynamics of the insertion of renewable technologies in an electricity market

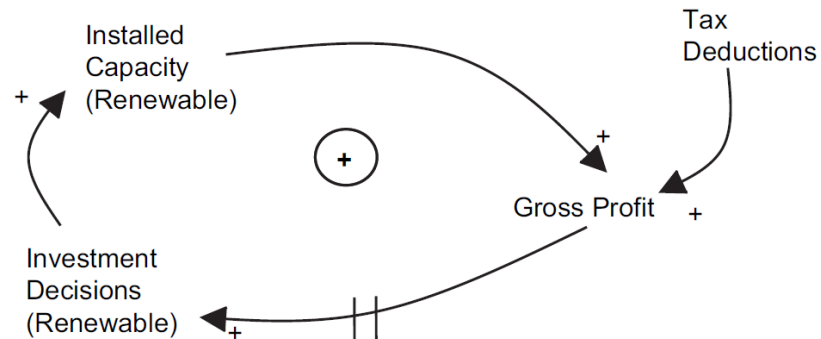


Fig. 14. Influence of income tax on the expansion of wind energy capacity.

Experimenting: early days

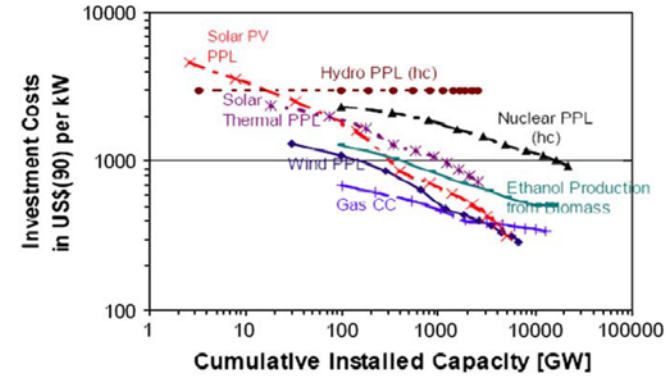


Fig. 8. Learning curve. Source: [18].

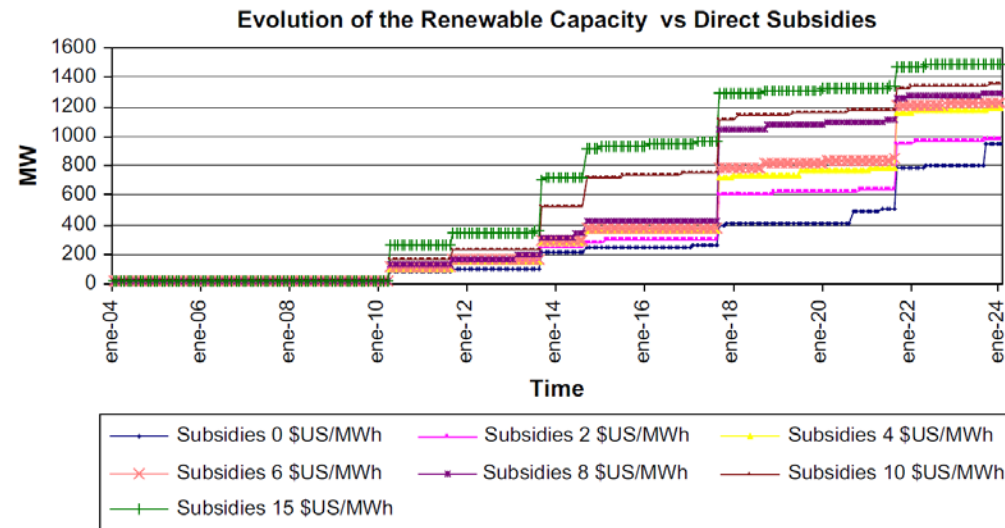
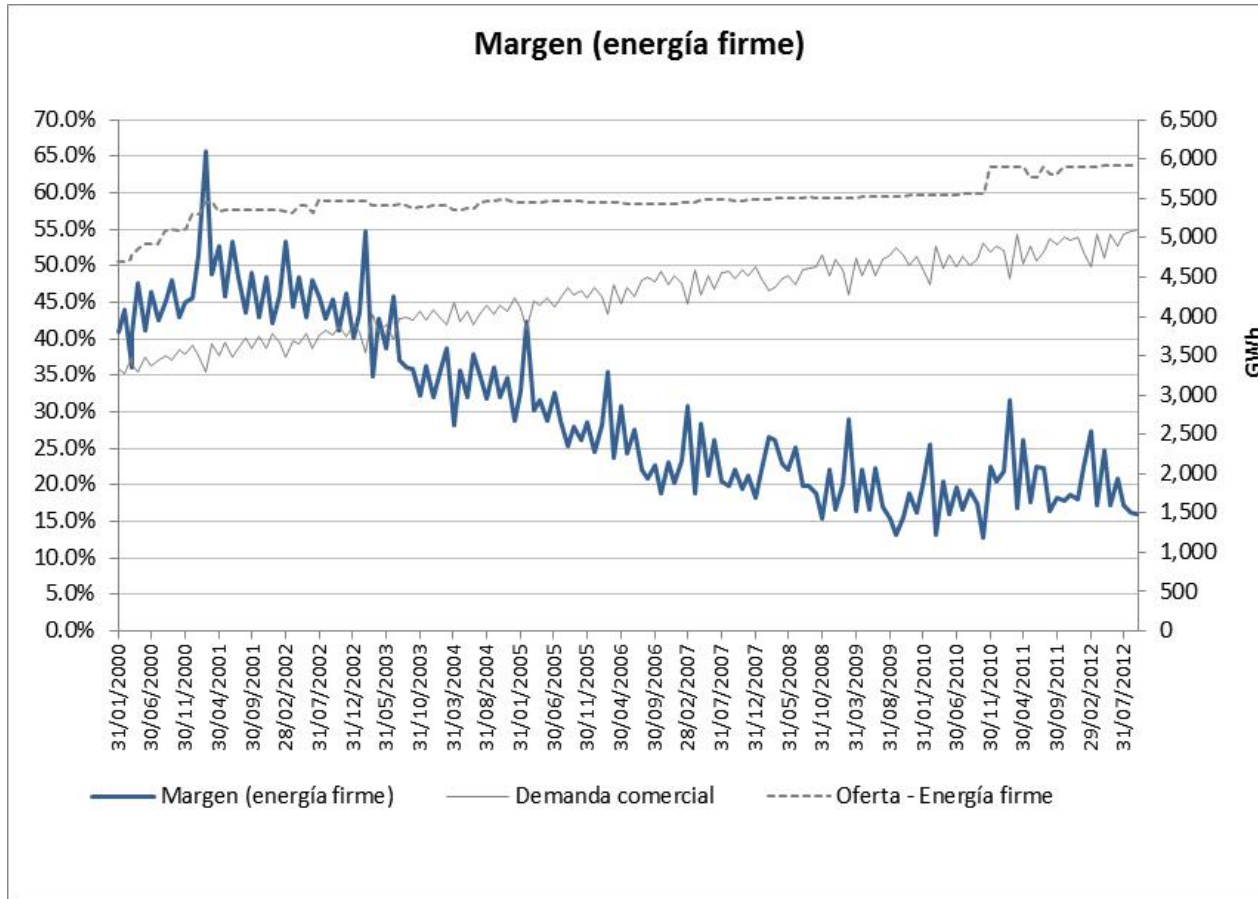


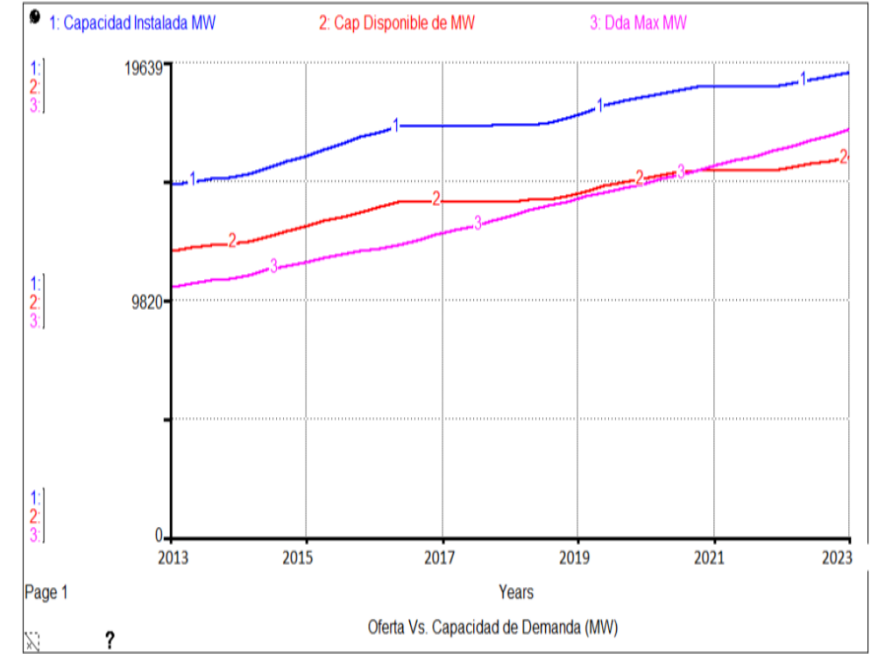
Fig. 18. Effect of direct subsidies on the installed capacity of a renewable (wind).

Playing with fire... At the brink of a blackout

Margen shrinks

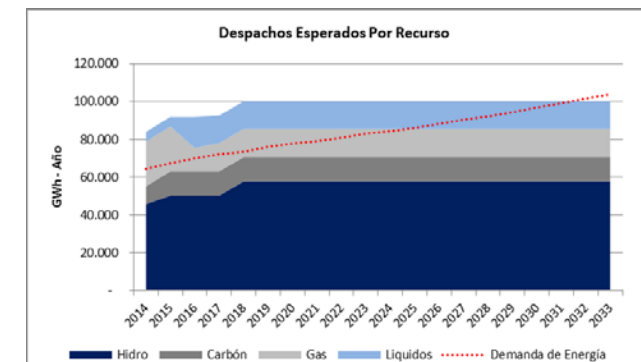


Source: Own using XM data

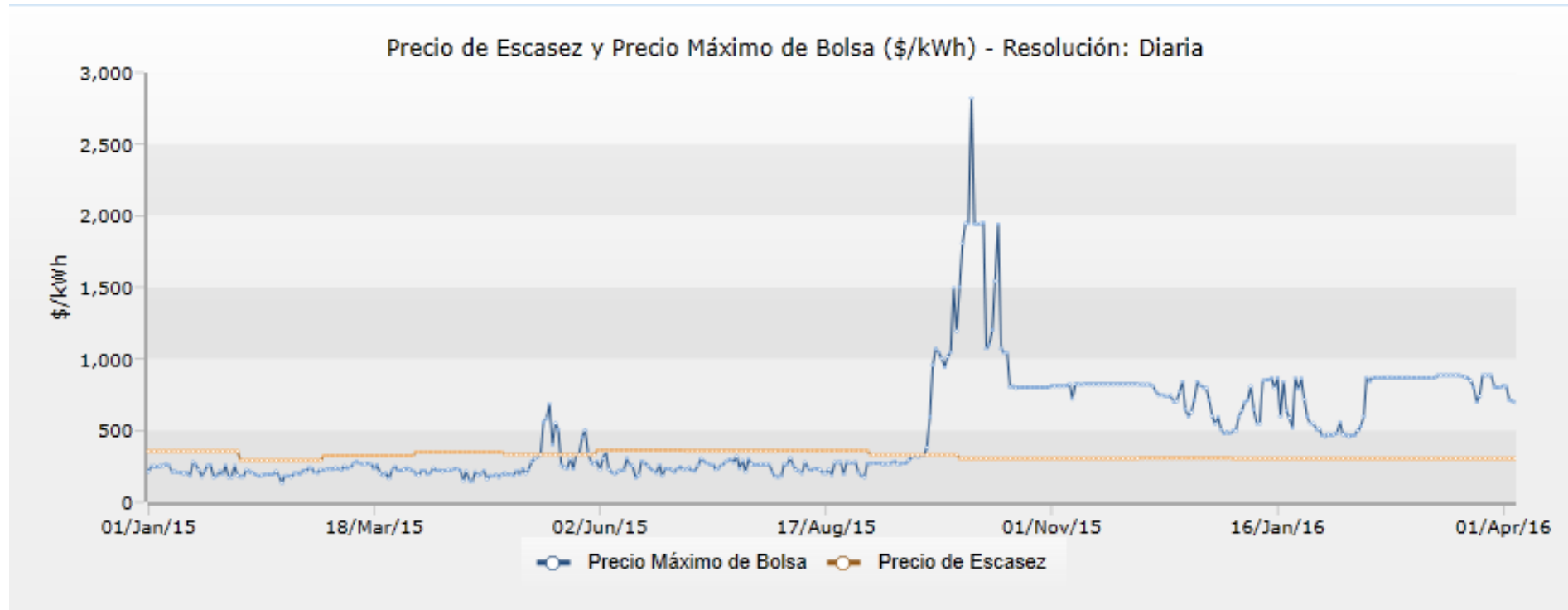


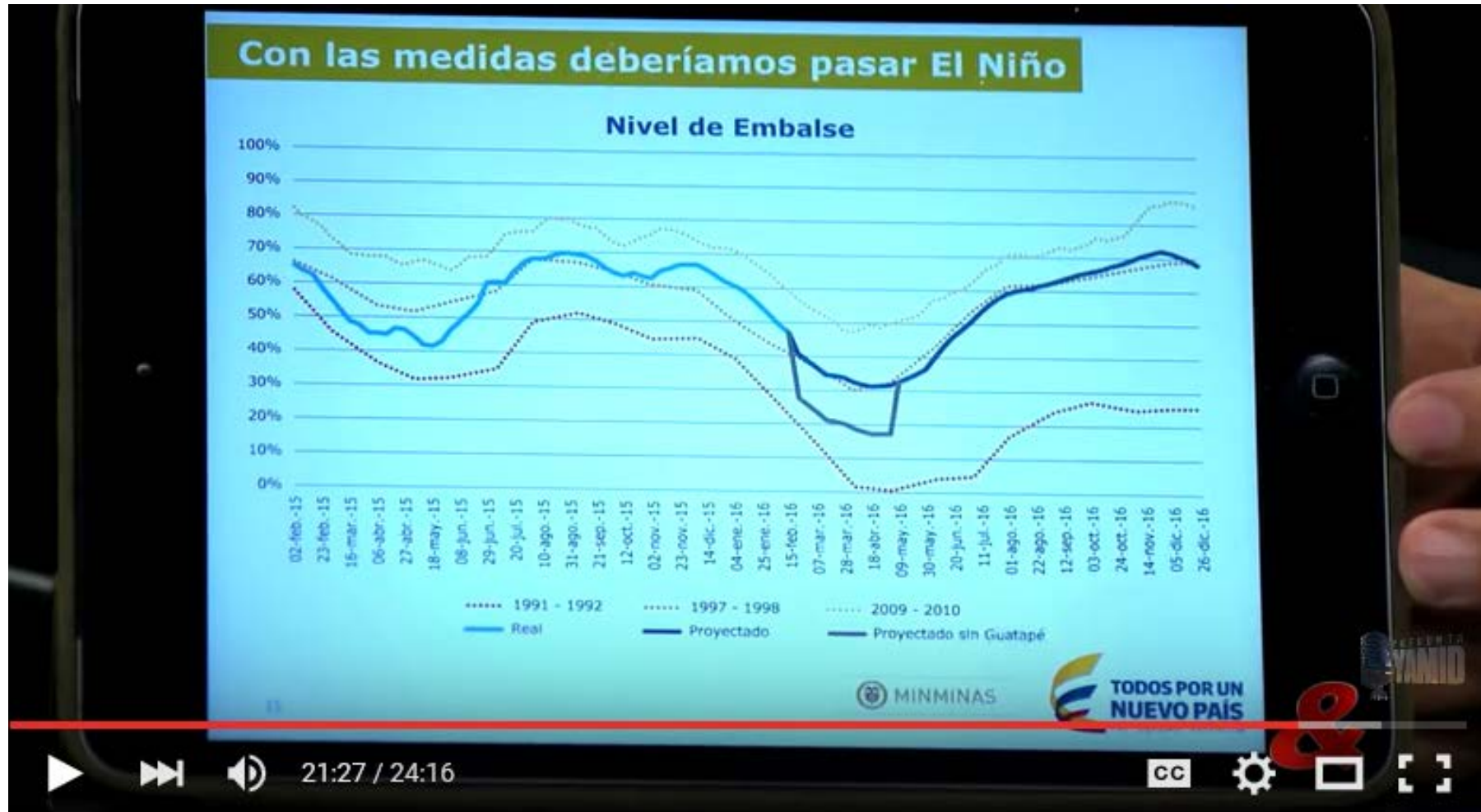
Our scenarios: Oferta Disponible de MW Vs. Capacidad Máxima de Potencia

Afanador, 2014



At the actual edge a of razor blade





The Minister of Energy and Mines on national TV in the middle of the crisis



The Minister did not remain in office (March 7, 2016)... and the president took over!

Week 2



Week 3

El presidente Juan Manuel Santos contento por el segundo día que el país supera la meta de ahorro de energía Foto: SIG

Did institutions work? YES!!! not markets!

Delays of Hidroituango

The largest Hydroelectric facility being built in Colombia (about 17% of demand) was at the edge of collapse – due to operate by 2018.



When you count on such a big facility (not fully operational before 2024).... margins get tight, and you have to move fast

INFRAESTRUCTURA

Julio 08 De 2018 - 06:25 P. M.

¿Cómo reemplazar la energía de Hidroituango?

Primero debemos garantizar el abastecimiento inmediato y luego nos tomamos unos meses para enfrentar los problemas de más largo plazo.

Nos quedan, entonces, un par de opciones para el corto y mediano plazo. Se propone poner en marcha un plan de difusión de energías renovables, al mismo tiempo que promover iniciativas con gran contenido de participación del consumidor final.

How to replace the energy of Hidroituango?

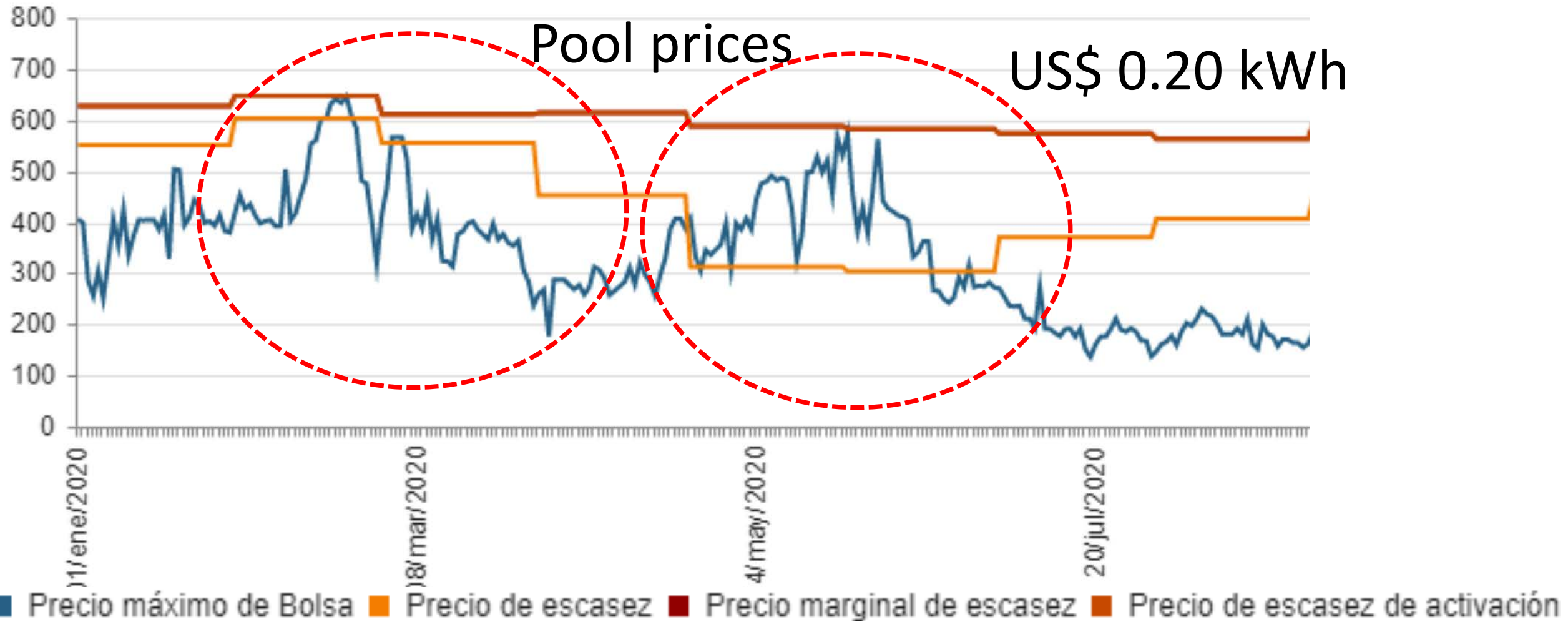
Renewables and demand participation, I wrote in July 2018

Progress and commitments 2019-2021

The new government (Duque's) didn't have many alternatives:

- Two auctions resulted in about 2.4GW of new renewables by 2022
- Transmission lines were auctioned to support new renewables
- Implementation of Law 1715 started to move ahead!
- Many new projects registered at UPME
- 51% emission reduction by 2030
- Carbon neutrality by 2050

Precio de escasez y precio máximo de Bolsa(\$/kWh) - Resolución: Diaria



Source: XM's webpage

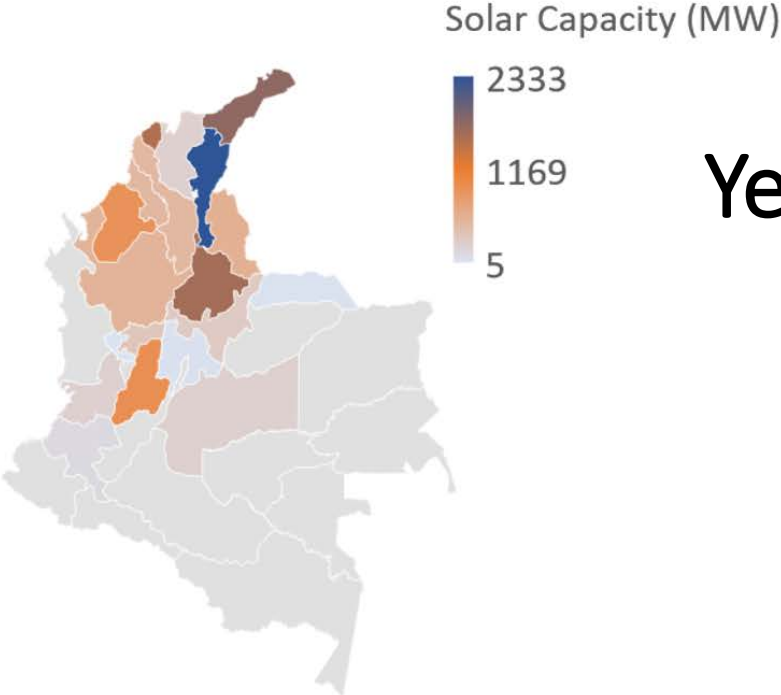
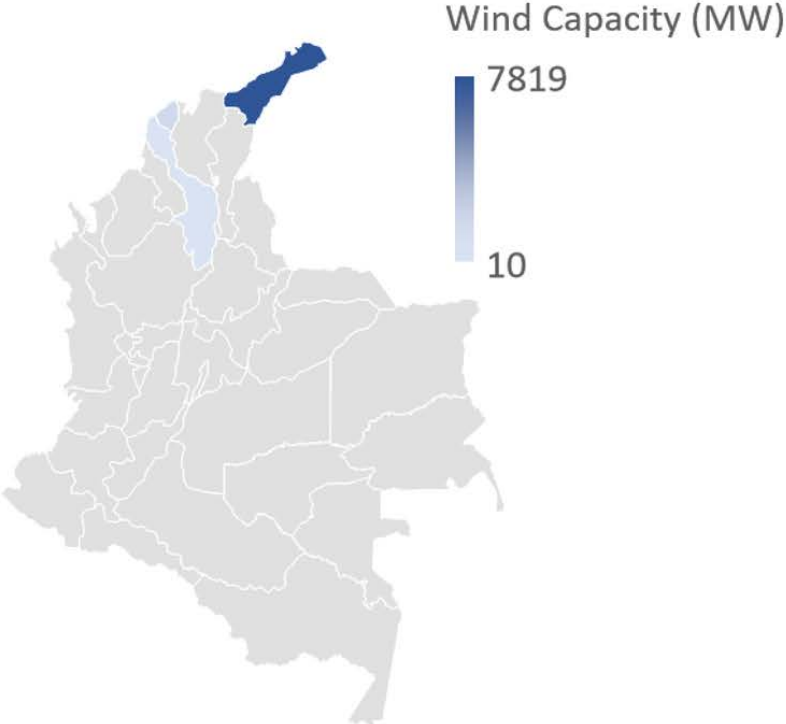
In early 2020 demand was low but rainy season wasn't good

Challenges ahead

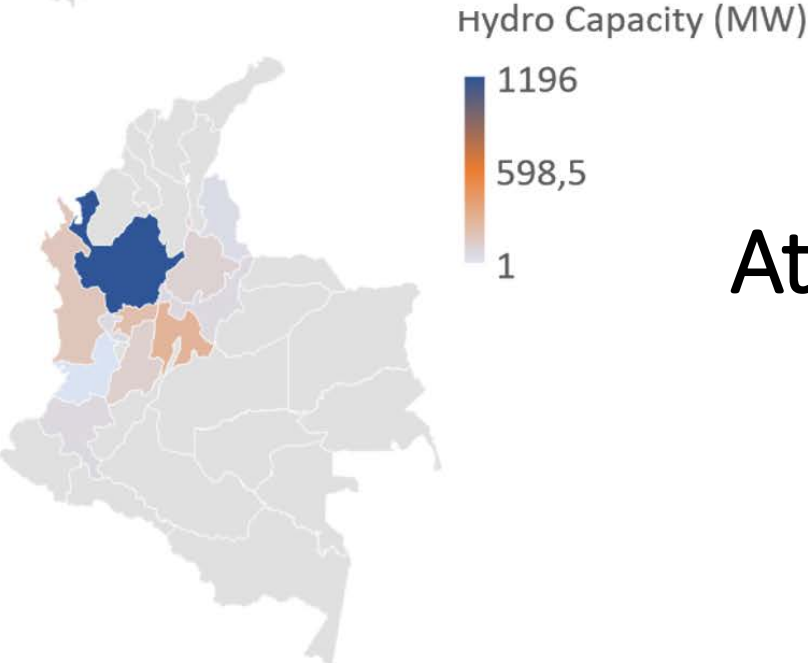
- Delays in transmission...
- Delays in some new energy farms...
- Further problems with Hidroituango – first stage 2022?

There is no alternative or
Lights won't remain on

By 2024



Yes, we can!



At least 7GW should be running!

**Copey – Cuestecitas 220 kV
Convocatoria (2016)
Abierta
Eólica 680 MW**

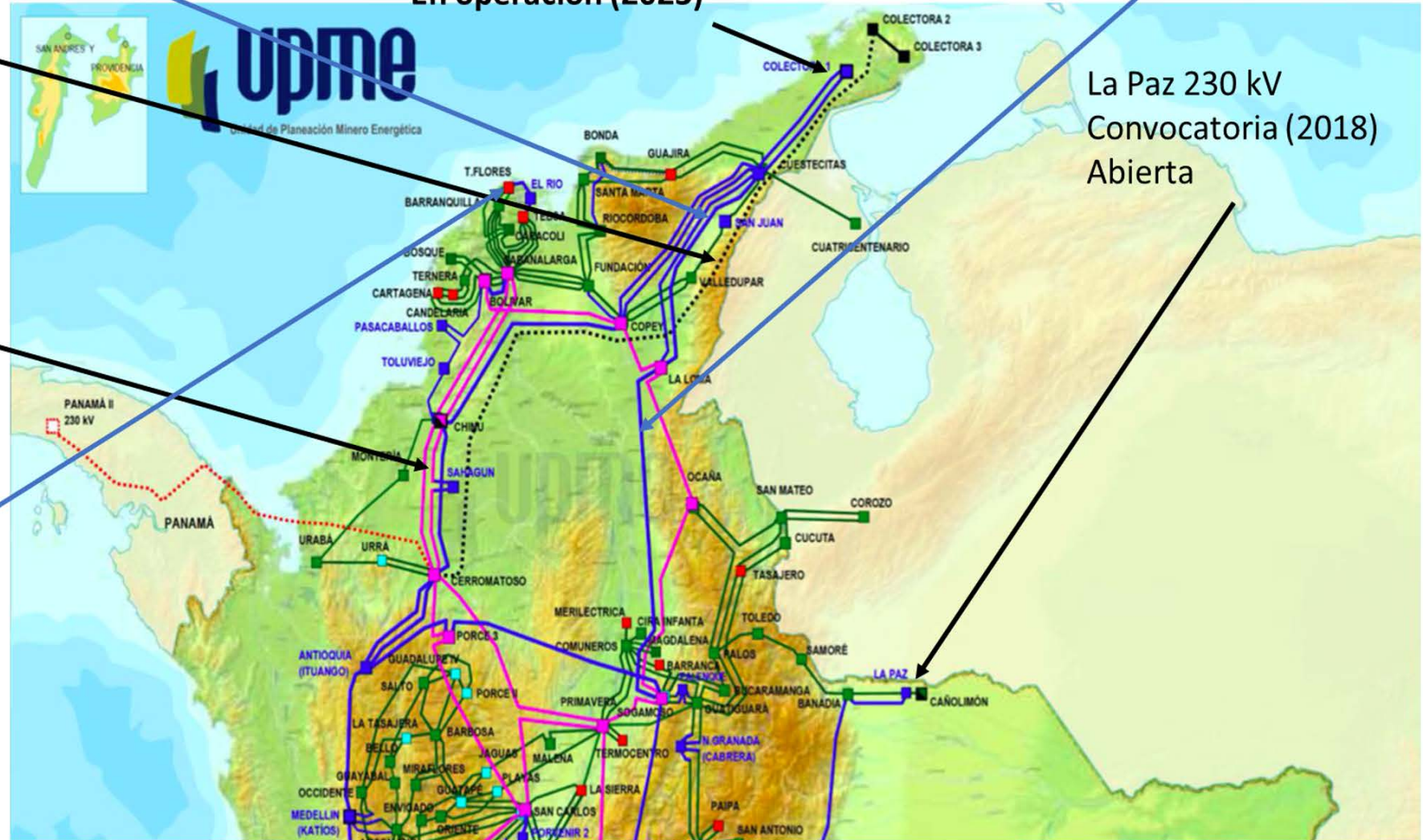
**Colectora 1 – 500 kV
Convocatoria (2017) – Adjudicado (2018)
En operación (2022)
Conecta 7 parques eólicos (1050 MW)
En operación (2023)**

**Colectora 2 y 3
Exclusiva ren.
Convocatoria N/A
Eólica**

**Sahagún 500 kV
Convocatoria (2019)
Abierta**

**Refuerzo Costa Caribe
Convocatoria (2014)
En ejecución**

**La Paz 230 kV
Convocatoria (2018)
Abierta**





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Energy

journal homepage: www.elsevier.com/locate/energy

Diffusion of renewable energy technologies: The need for policy in Colombia

Maritza Jimenez^a, Carlos J. Franco^a, Isaac Dyner^{a, b, *}^a Universidad Nacional de Colombia, Colombia^b Universidad Jorge Tadeo Lozano, Colombia

Renewable and Sustainable Energy Reviews 80 (2017) 341–351



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journal homepage: www.elsevier.com/locate/rser

Evaluating the effect of technology transformation on the electricity utility industry

Renewable Energy 132 (2019) 81–92



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Renewable Energy

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Optimising the insertion of renewables in the Colombian power sector

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Journal of Cleaner Production 112 (2016) 3759–3773



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Journal of Cleaner Production

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Assessing emissions—mitigation energy policy under integrated supply and demand analysis: the Colombian case

Laura Milena Cardenas^a, Carlos Jaime Franco^a, Isaac Dyner^{b, *}^a Universidad Jorge Tadeo Lozano, Ceiba, Colombia

Energy Policy 131 (2019) 9–21



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Clean and secure power supply: A system dynamics based appraisal

Sebastian Zapata^a, Monica Castaneda^a, Carlos Jaime Franco^b, Isaac Dyner^{a, b, *}^a Universidad Jorge Tadeo Lozano, Bogotá, Colombia^b Universidad Jorge Tadeo Lozano, Bogotá, Colombia

Renewable and Sustainable Energy Reviews 134 (2020) 110318



Contents lists available at ScienceDirect

Renewable and Sustainable Energy Reviews

journal homepage: <http://www.elsevier.com/locate/rser>

Annual and interannual complementarities of renewable energy sources in Colombia

Felipe Henao^{a, *}, Juan P. Viteri^a, Yeny Rodríguez^a, Juan Gómez^a, Isaac Dyner^b^a Universidad Icesi, Facultad de Ciencias Administrativas y Económicas, Calle 18 No. 122 -135, Cali, Colombia^b Facultad de Ciencias Naturales e Ingeniería, Universidad Jorge Tadeo Lozano, Carrera 4 # 22-61, Bogotá, Colombia

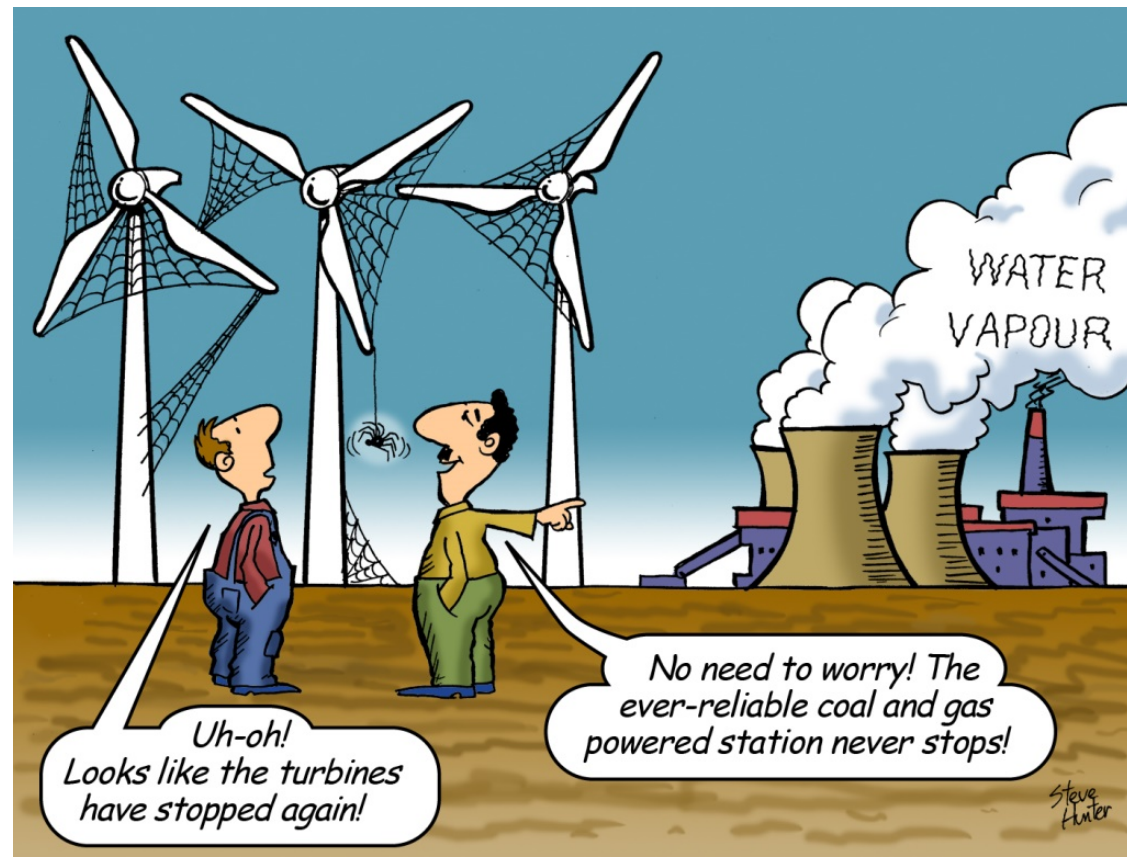
There is need for implementing:

- Well developed contract market
- Marginal pricing for balancing, only
- Balancing mechanism just before dispatch
- Demand participation – distributed generation

Will we?

And getting a hand from Energy economics and Political economy!

**Rather than
confronting:**





Thank you!

We must!

... y el sustento: el día que deje de salir sol y la luna deje de alumbrar ... ese día...