

BETWEEN MOORE AND MAXWELL

Jorge Vasconcelos

NEWES, New Energy Solutions

12 th EU-US Energy Regulators Roundtable

Madrid, April 25, 2016

SMART GRIDS ARE NOT FRIGHTENING

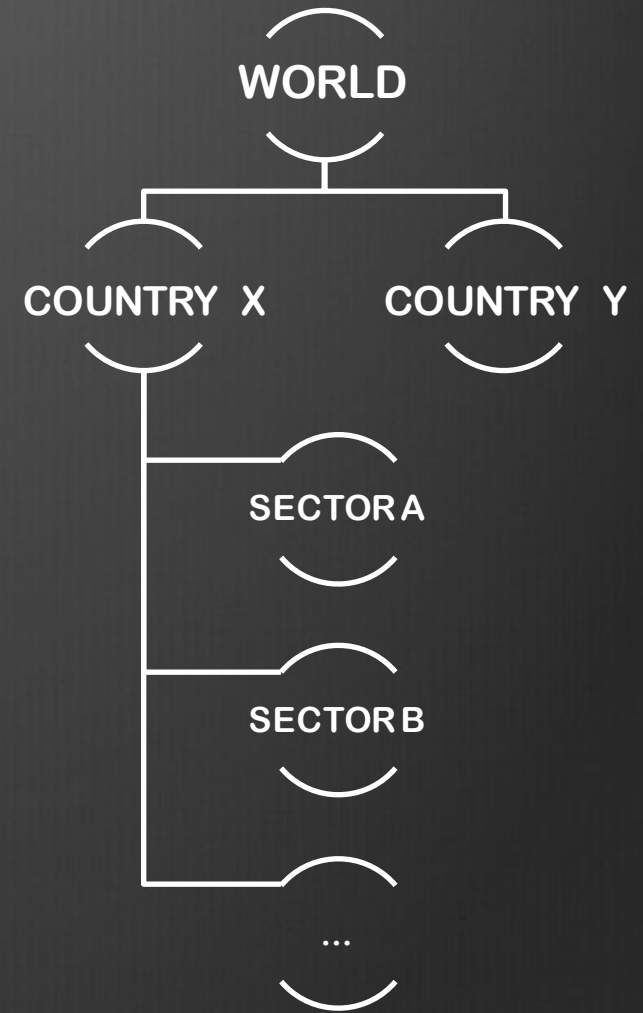
Monkeying around - escaped chimp causes chaos in Japan

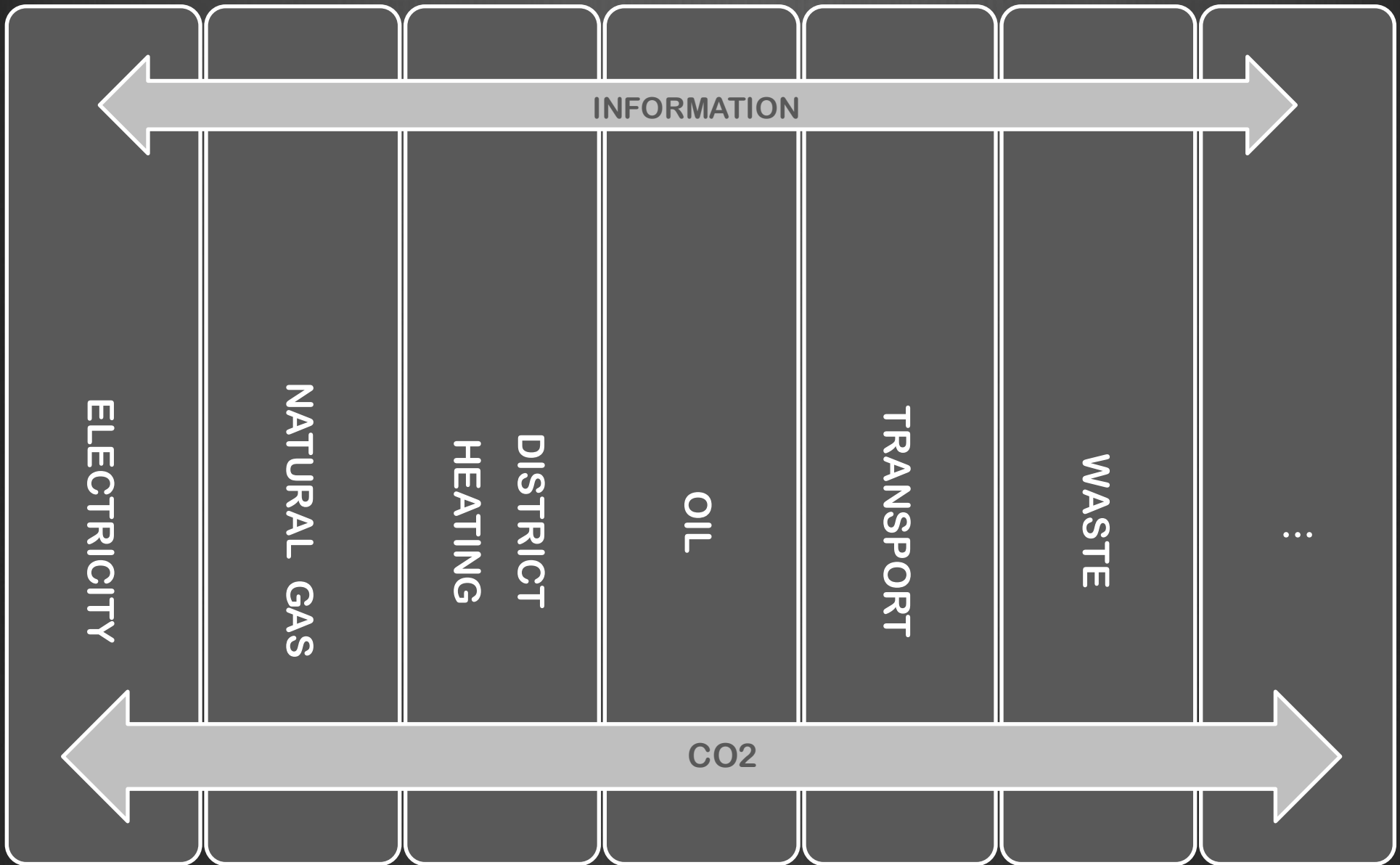


An on-the-run chimpanzee evaded capture by swinging from power lines in the north of Japan. The chimp, who had escaped from nearby Yagiyama Zoological Park, was eventually caught after being shot with a tranquillizer gun.

Credit: REUTERS/Kyodo

PARIS AND BEYOND



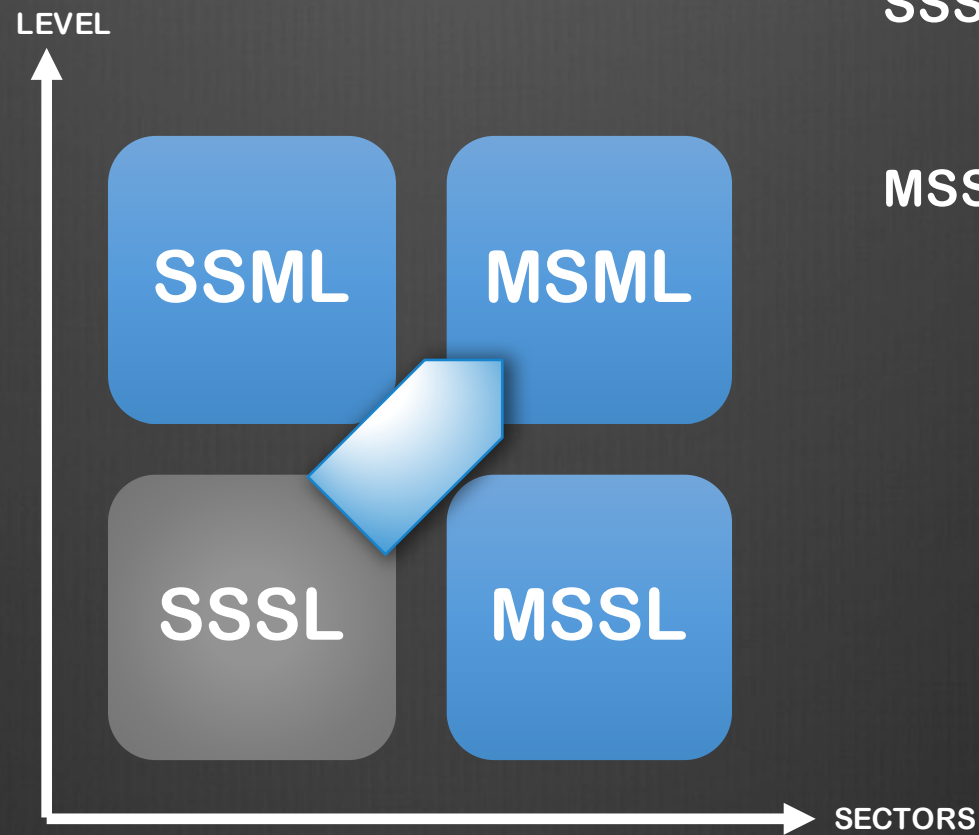


SSML: Single Sector
Multiple Level

MSML: Multiple Sector
Multiple Level

SSSL: Single Sector
Single Level

MSSL: Multiple Sector
Single Level



" reducing greenhouse gas emissions by 80-95% by 2050 compared to 1990 as agreed in October 2009 will require a revolution in energy systems, which must start now "

European Council, February 2011

SEVERAL ALTERNATIVE PATHS MAY LEAD TO 2050

DIFFERENT
PATHS
REQUIRE
DIFFERENT
ROLES



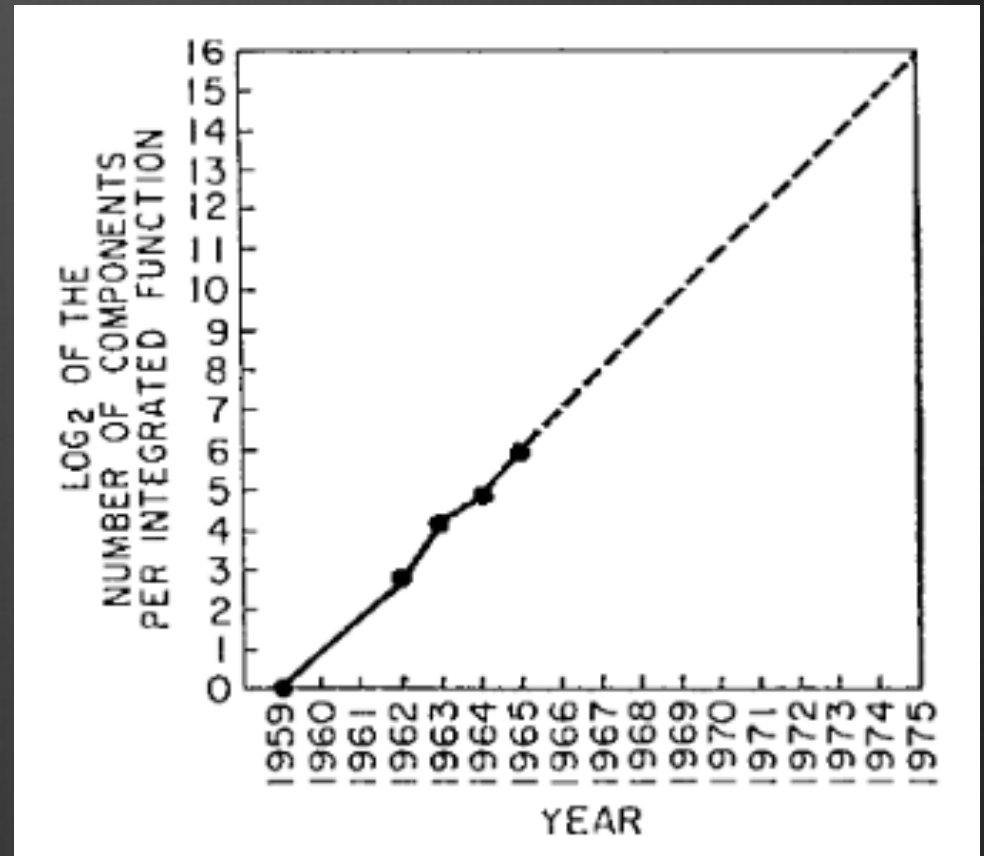
DIFFERENT
NATIONAL
PATHS
MAY COEXIST –
FULL
HARMONIZATION
IS NOT A PRE-
CONDITION FOR
WELL-
FUNCTIONING
IEM

BUT FULL CONSISTENCY IS !



Gordon Moore, co-founder of Intel.

MOORE



Gordon E. Moore, "Cramming More Components onto Integrated Circuits," Electronics, pp. 114–117, April 19, 1965

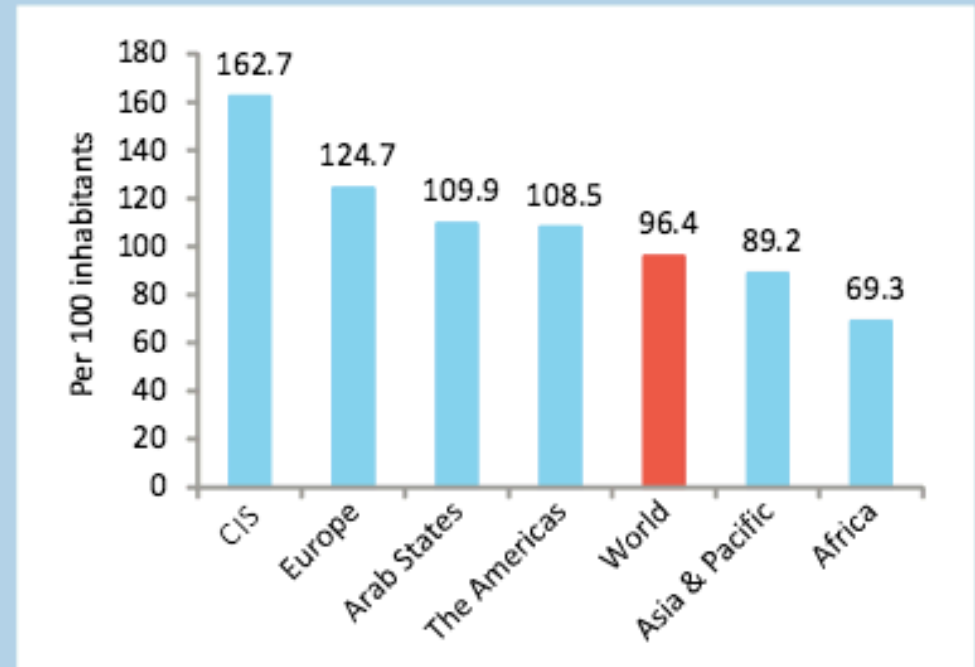
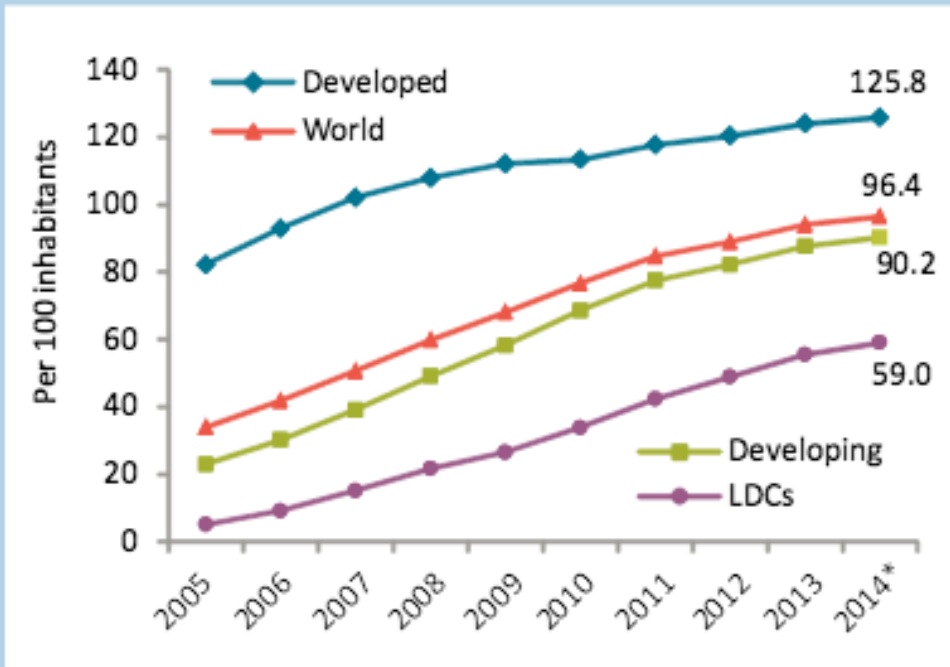


- By end 2015, there are more than 7 billion mobile cellular subscriptions, corresponding to a penetration rate of 97%, up from 738 million in 2000



- The proportion of the population covered by a 2G mobile-cellular network grew from 58% in 2001 to 95% in 2015

Chart 1.2: Mobile-cellular subscriptions by level of development, 2005-2014 (left) and by region, 2014* (right)



Note: *Estimate.
Source: ITU World Telecommunication/ICT Indicators database.

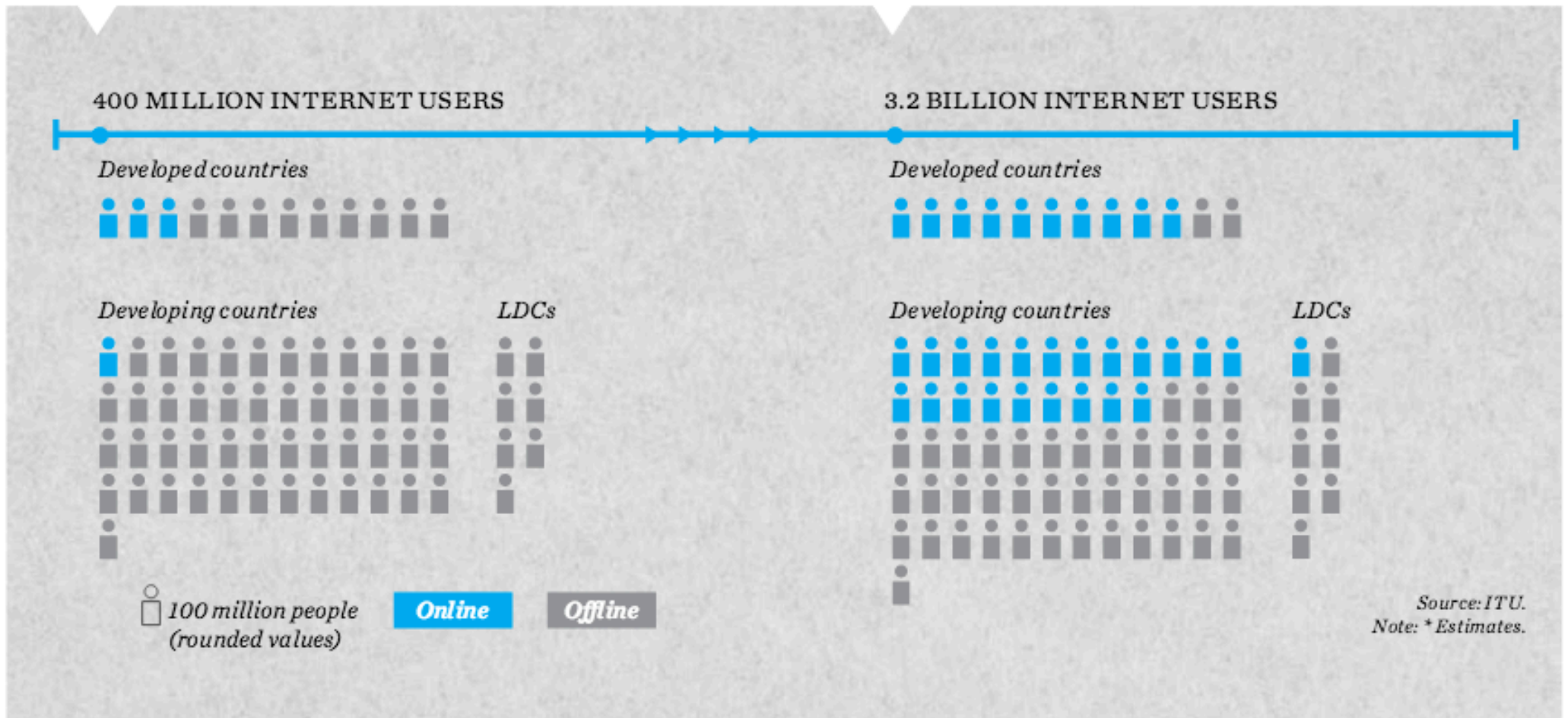
http://www.itu.int/en/ITU-D/Statistics/Documents/publications/mis2014/MIS2014_without_Annex_4.pdf



- Between 2000-2015, global Internet penetration grew 7 fold from 6.5% to 43%

2000

2015*



<http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2015.pdf>

EU interconnected network

National network

HV network

MV network

LV network

LV feeder

Building

Household

Appliance



Thanks to modern ICT full control at any level is possible

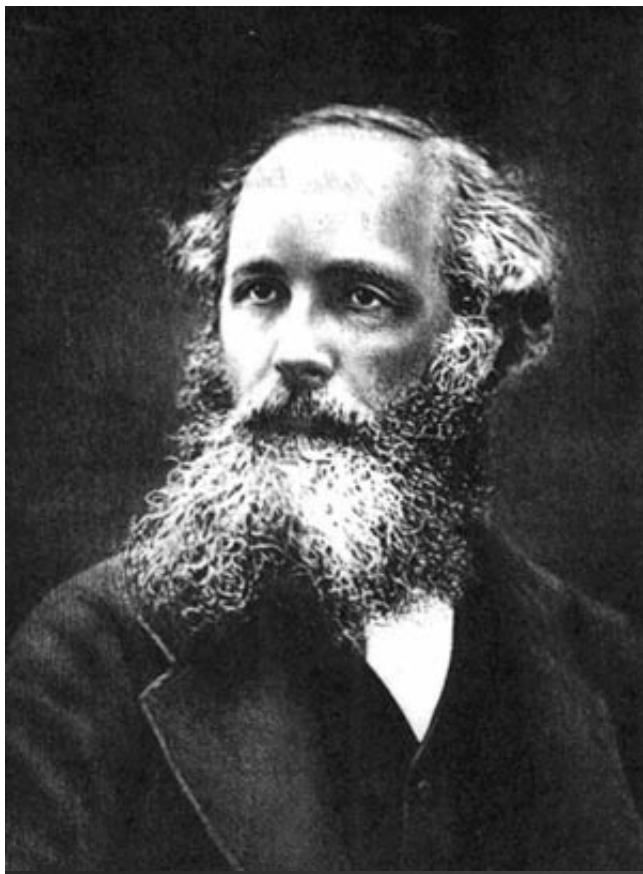
“Give me a fixed point and I will move the world.”

Archimedes



“Give me a router and I will move the electricity market.”

Jorge Vasconcelos

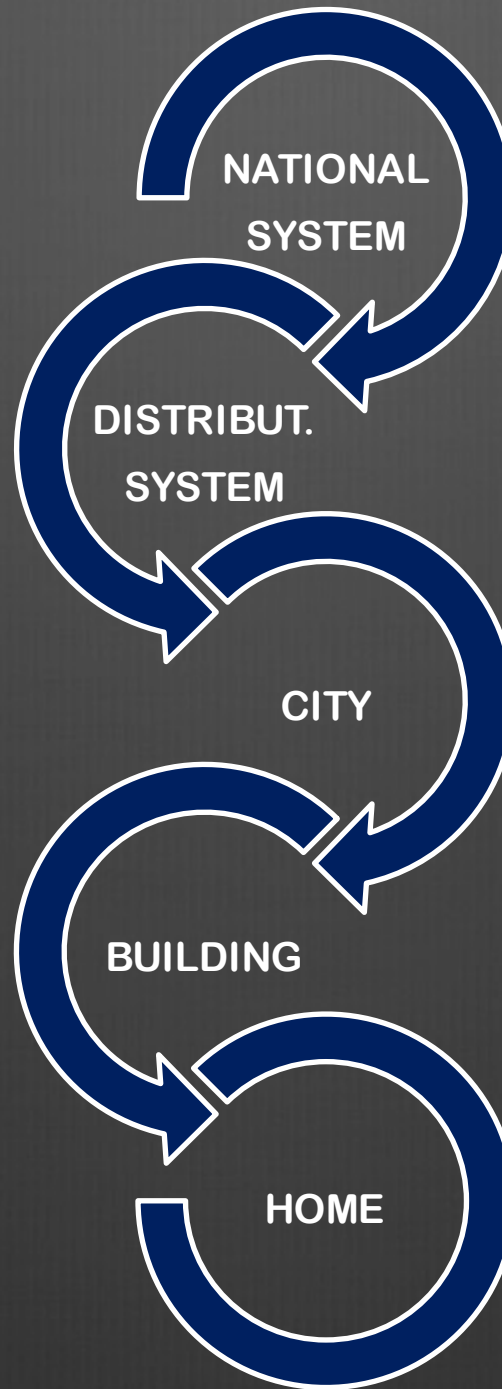


<http://www.biographyonline.net/scientists/james-maxwell.html>

MAXWELL



IC
TECHNOLOGIES
INTRODUCE
THE
CONTROL
FLOW
PROBLEM



THE CONTROL FLOW
PROBLEM:

WHO CONTROLS WHAT
AND
WHO COORDINATES ?

“the control flow problem” :

1) How to ensure control at each level ?

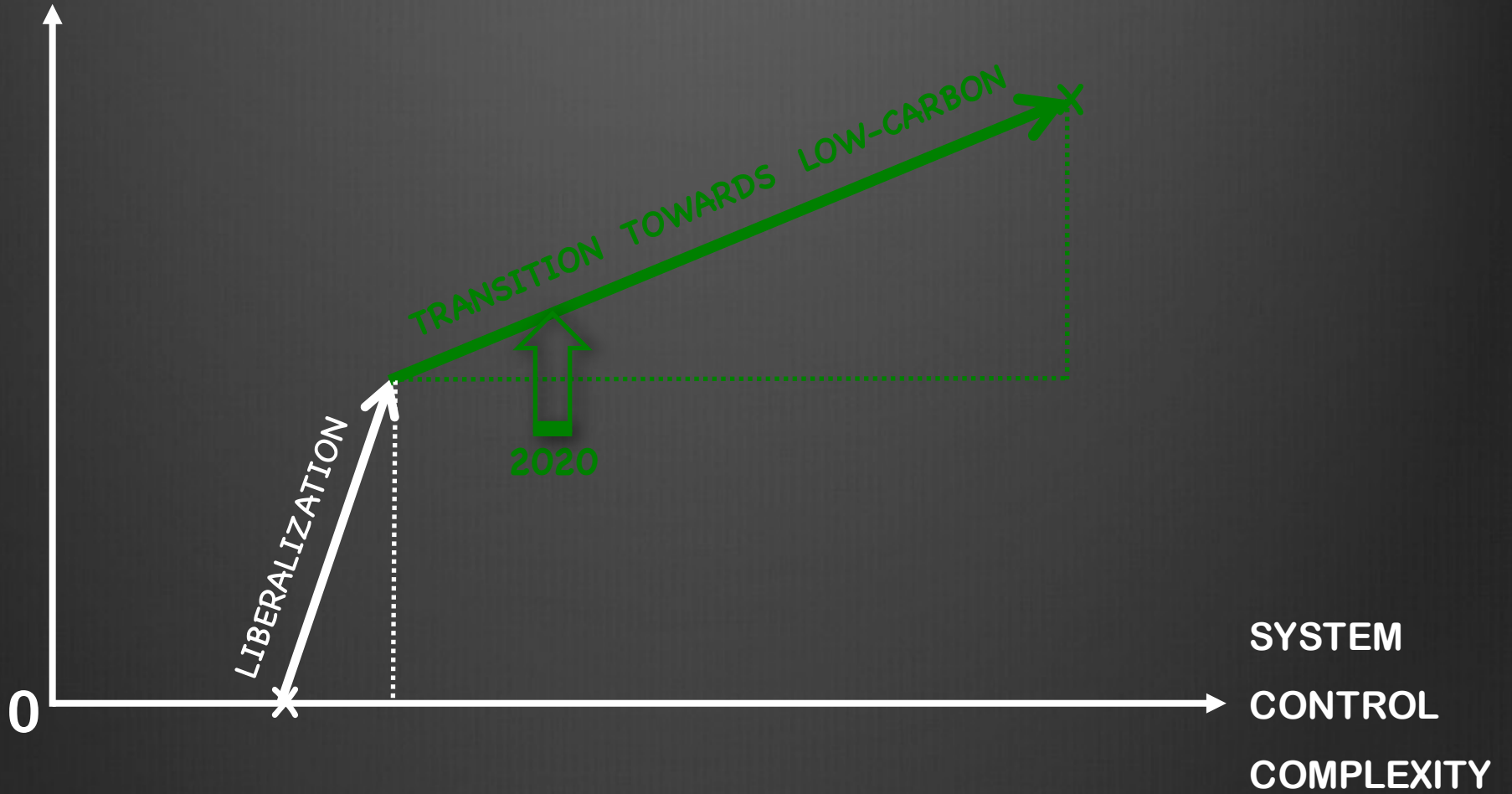
Within each layer, different control policies can be implemented, from a highly centralized approach, more or less replicating at each level the current national master/slave hierarchical structure, down to a fully decentralized structure.

2) How to define functional interfaces between layers ?

In order to ensure effective coordination of the whole system it is necessary to exchange information between layers and to establish clear communication and control procedures. Protocols must be implemented both for normal and for abnormal operational conditions.

3) Who is the “controller of the controllers” and “controller of last resort” ?

MARKET
COMPLEXITY



Control complexity, before and more than market complexity, is the problem

Energy

markets

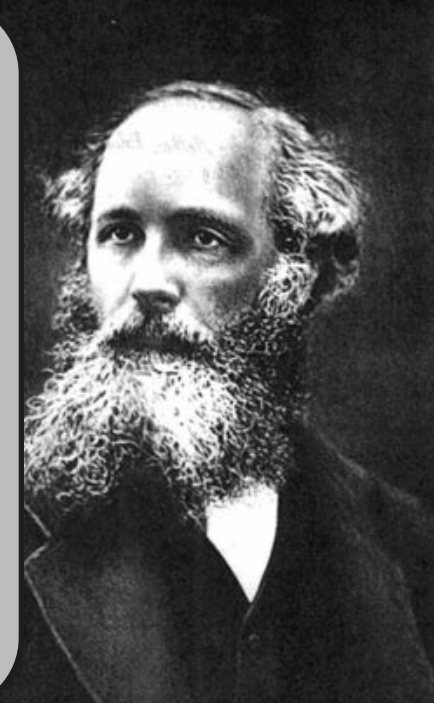
Thinking
outside
the box





INNOVATION

REALITY
CHECK





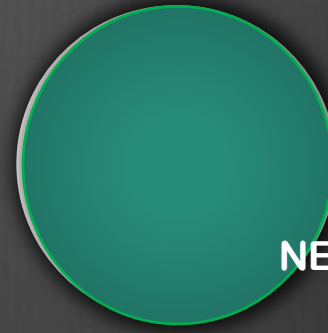
OLD REGULATION

TODAY



REGULATION FOR
TRANSITION
TRANSIENT
REGULATION

TRANSITION



NEW REGULATION

LOW CARBON
FUTURE

Regulation

- government
- market agents

- market agents
- government
- regulators
- newcomers
(ICT)

energy
mix

market



regulation

system
operation

- regulators
- academics

- TSO
- DSO
- regulators
- EC

Governance

CONCLUSIONS

STARTING POINT : PARIS

TRANSITION : COMPREHENSIVE (MSML ARCHITECTURE)

CONSISTENT (TECHNOLOGICAL)

INNOVATIVE AND REALISTIC

INNOVATION : MARKET DESIGN

SYSTEM OPERATION

REGULATION

GOVERNANCE : ENSURE CONSISTENCY

NOW AND ALONG THE ROAD