



Technical Council Strategy 2016

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Technical Council Chairman

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"My" world

A1
ROTATING
ELECTRICAL MACHINES

A2
TRANSFORMERS

A3
HIGH VOLTAGE
EQUIPMENT

B1
INSULATED
CABLES

B2
OVERHEAD
LINES

B3
SUBSTATIONS

B4
HVDC & POWER
ELECTRONICS

B5
PROTECTION &
AUTOMATION

C1
SYSTEM DEVELOPMENT
& ECONOMICS

C2
SYSTEM OPERATION
& CONTROL

C3
SYSTEM ENVIRONMENTAL
PERFORMANCE

C4
SYSTEM TECHNICAL
PERFORMANCE

C5
ELECTRICITY MARKETS
& REGULATION

C6
DISTRIBUTION SYSTEMS
& DISPERSED GENERATION

D1
MATERIALS & EMERGING
TEST TECHNIQUES

D2
INFORMATION SYSTEMS
& TELECOMMUNICATIONS



“The Energy Transition”

- ☐ Unprecedented (rate of) change
- ☐ Sustainability, environment & carbon reduction targets
- ☐ Intermittent DER
- ☐ Access to electricity
- ☐ Interconnection & bulk transportation
- ☐ Storage
- ☐ “SMART” T&D
- ☐ Sophisticated asset management
- ☐ Standardisation & interoperability



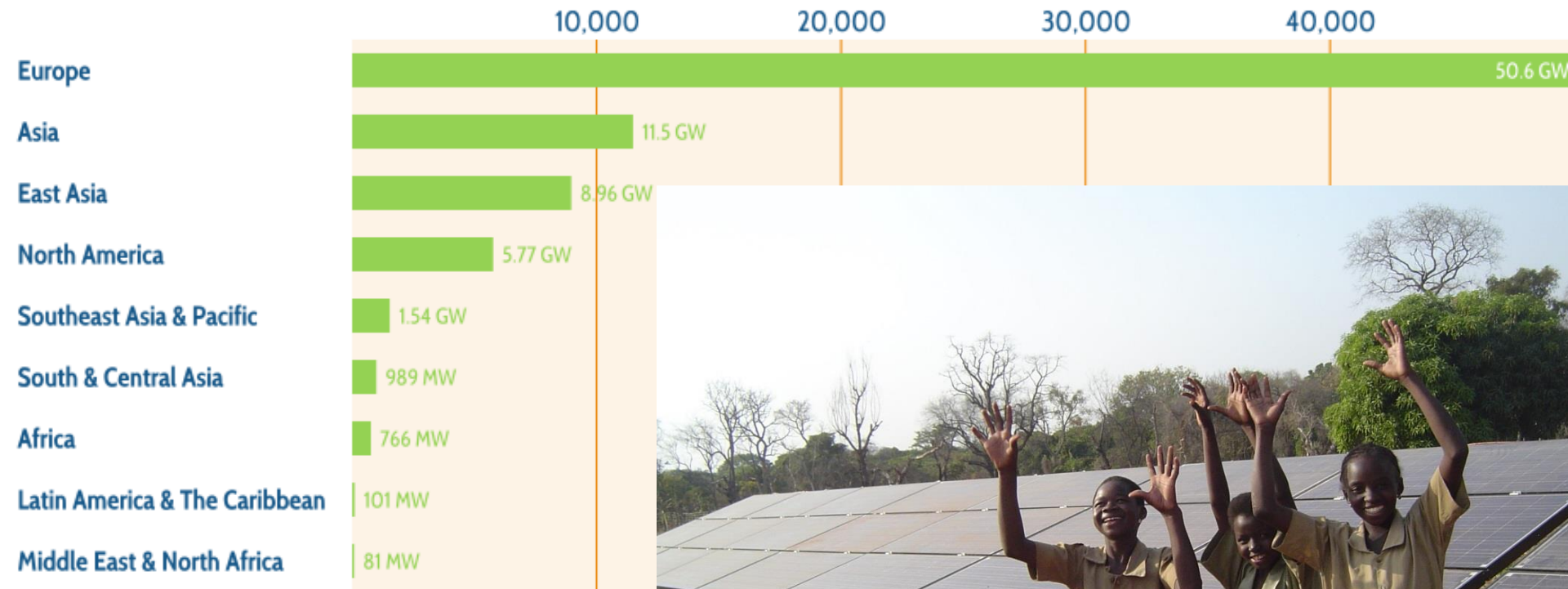
Policies & Incentives

- ☐ Carbon targets & sustainability
- ☐ Solar take-up rates
 - 20% cost reduction for each doubling of installed capacity
 - Commodity product
 - £17/MWh (Dubai) c/f £51/MWh for wind in Denmark
- ☐ Nuclear closures vs new nuclear
- ☐ SF₆ leakage
- ☐ Smart meter roll-outs
- ☐ Electrification
- ☐ Market design
- ☐ CIGRE: external vision & engagement with policy-makers?



Solar exploitation

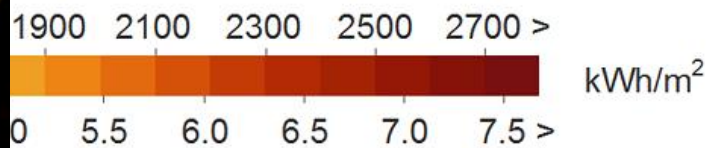
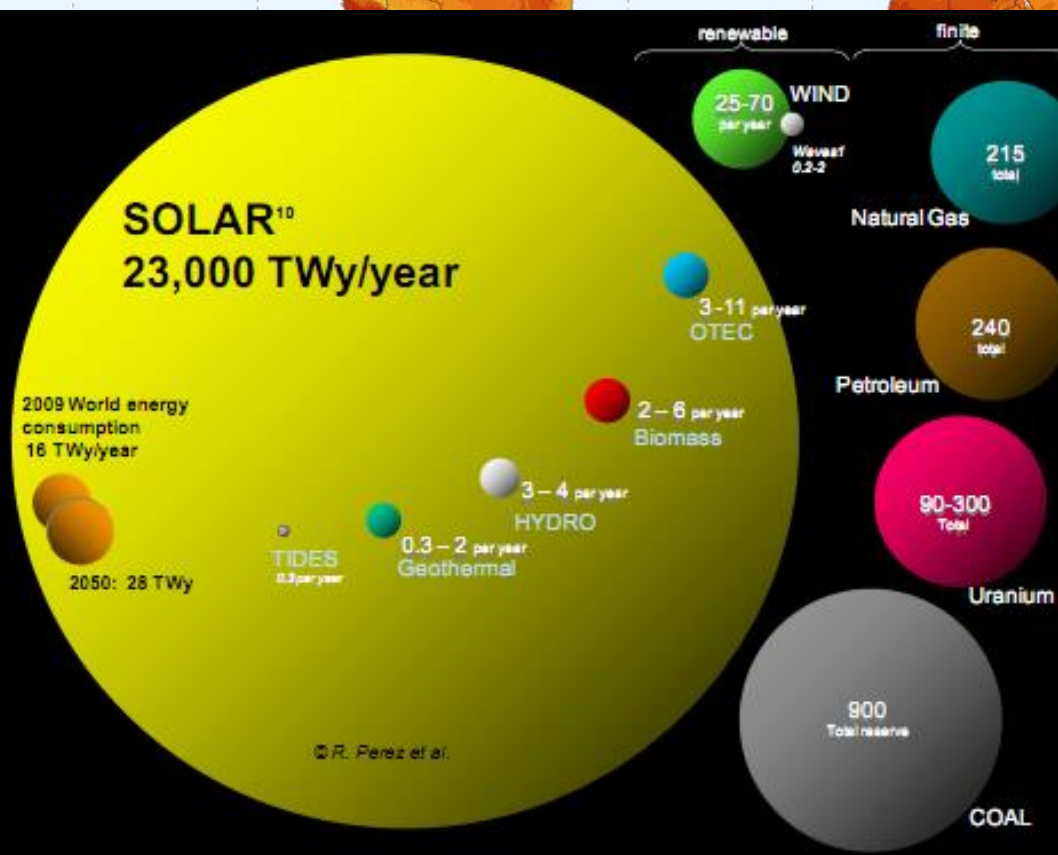
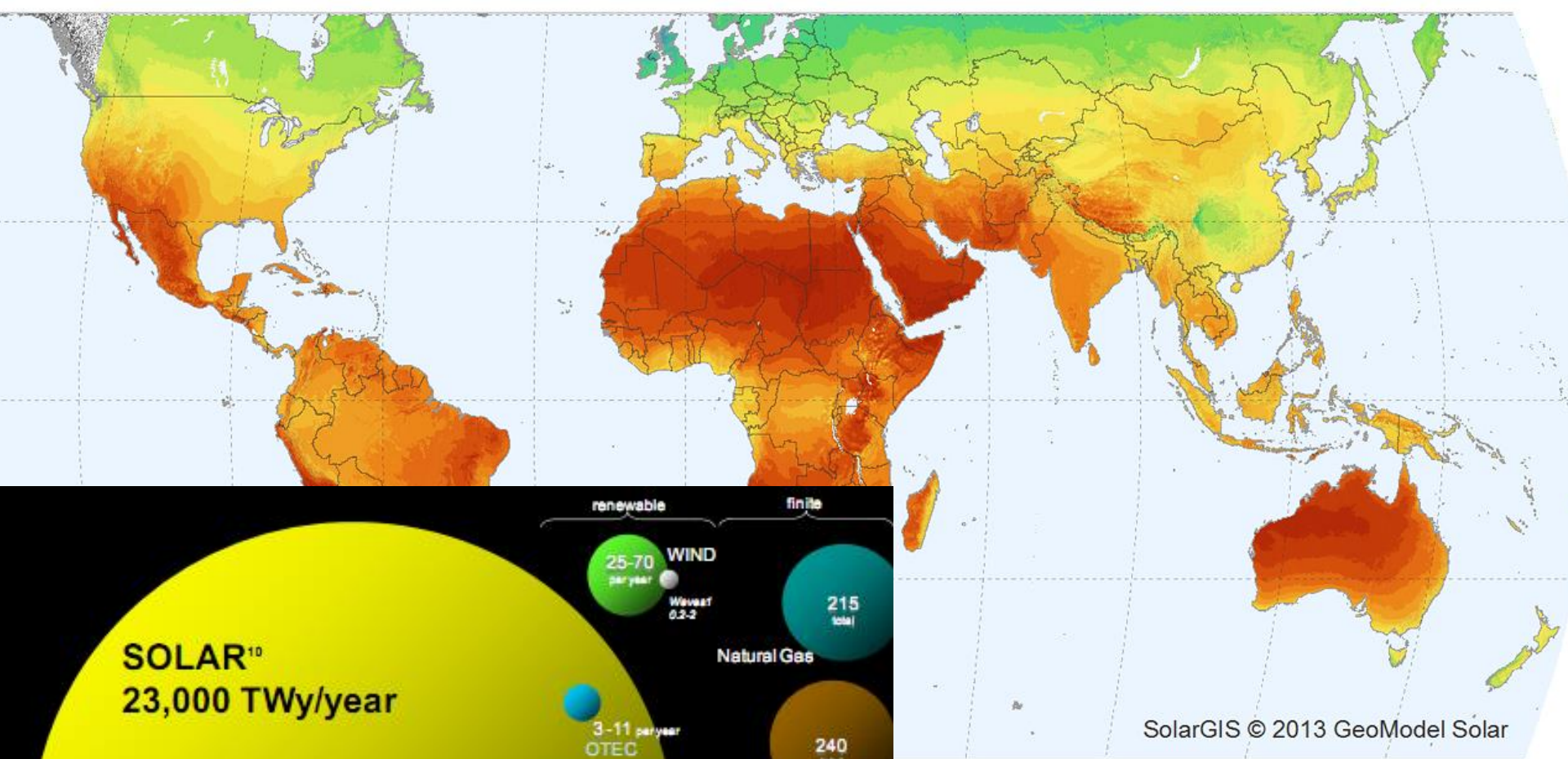
Solar installed capacity by region



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WEC conclusions

1. Energy system complexity will increase by 2050.
2. Energy efficiency is crucial in dealing with demand outstripping supply.
3. The energy mix in 2050 will mainly be fossil based.
4. Regional priorities differ: there is no 'one-size-fits-all' solution to the energy trilemma.
5. The global economy will be challenged to meet the 450ppm target without unacceptable carbon prices.

WEC conclusions

6.

A low-carbon future is not only linked to renewables: CC(U)S is important and consumer behaviour needs changing.

7.

CC(U)S technology, solar energy and energy storage are the key uncertainties up to 2050.

8.

Balancing the energy trilemma means making difficult choices.

9.

Functioning energy markets require investments and regional integration to deliver benefits to all consumers.

10.

Energy policy should ensure that energy and carbon markets deliver.



Uncertainty

☐ Modern Jazz

A future where enterprises are able to innovate and compete in open markets and supply low-cost energy for all

{low cost, higher carbon}

☐ Unfinished Symphony

A world where international agreements and national policies prevail and determine choices, but energy costs are high and there is still more work to do

{high cost, lower carbon}

☐ Hard Rock

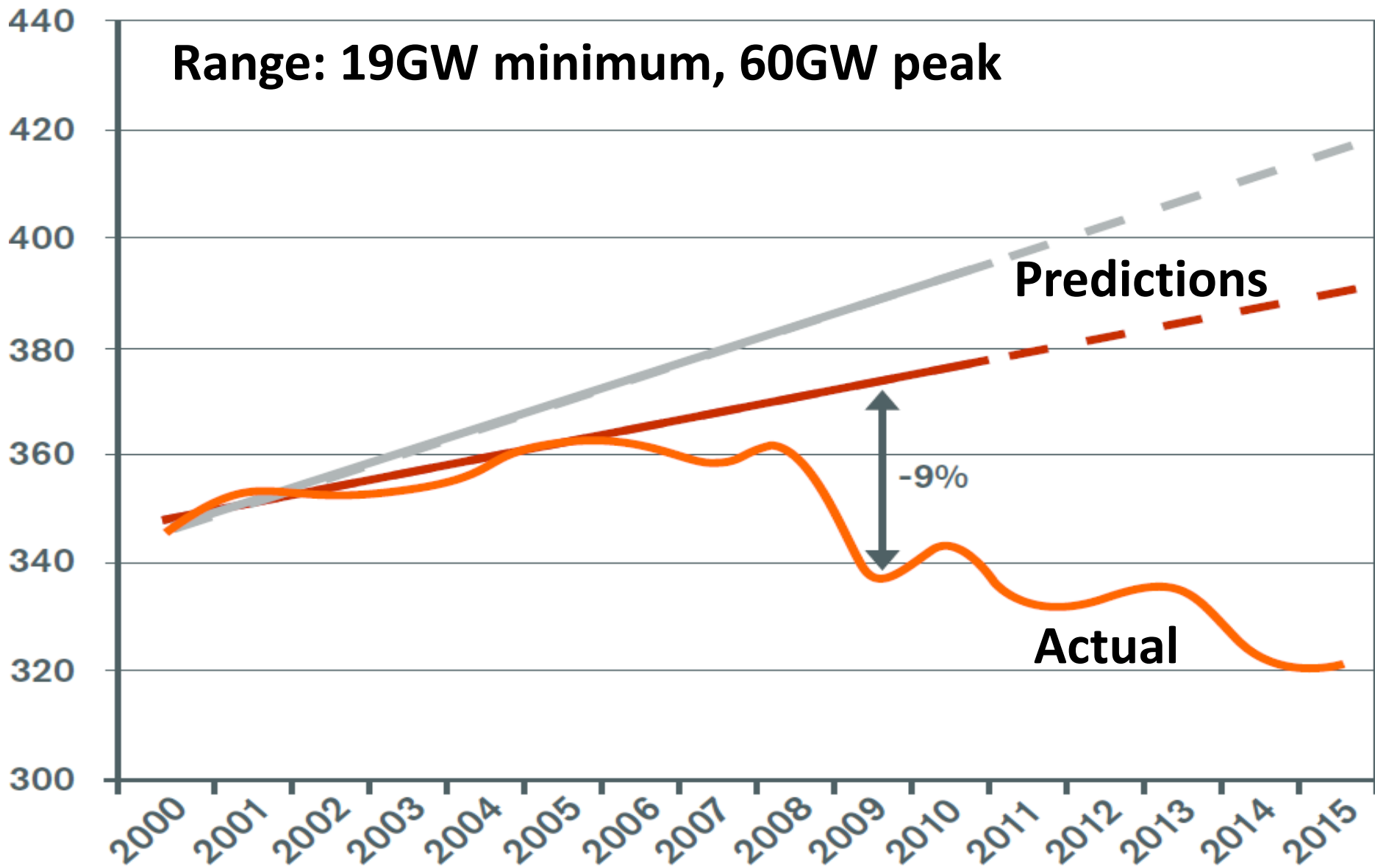
What we might see if nations have slower growth and become more conservative and less outward looking as a result of conflict, environmental chaos and migration crises

{just plain bad!}



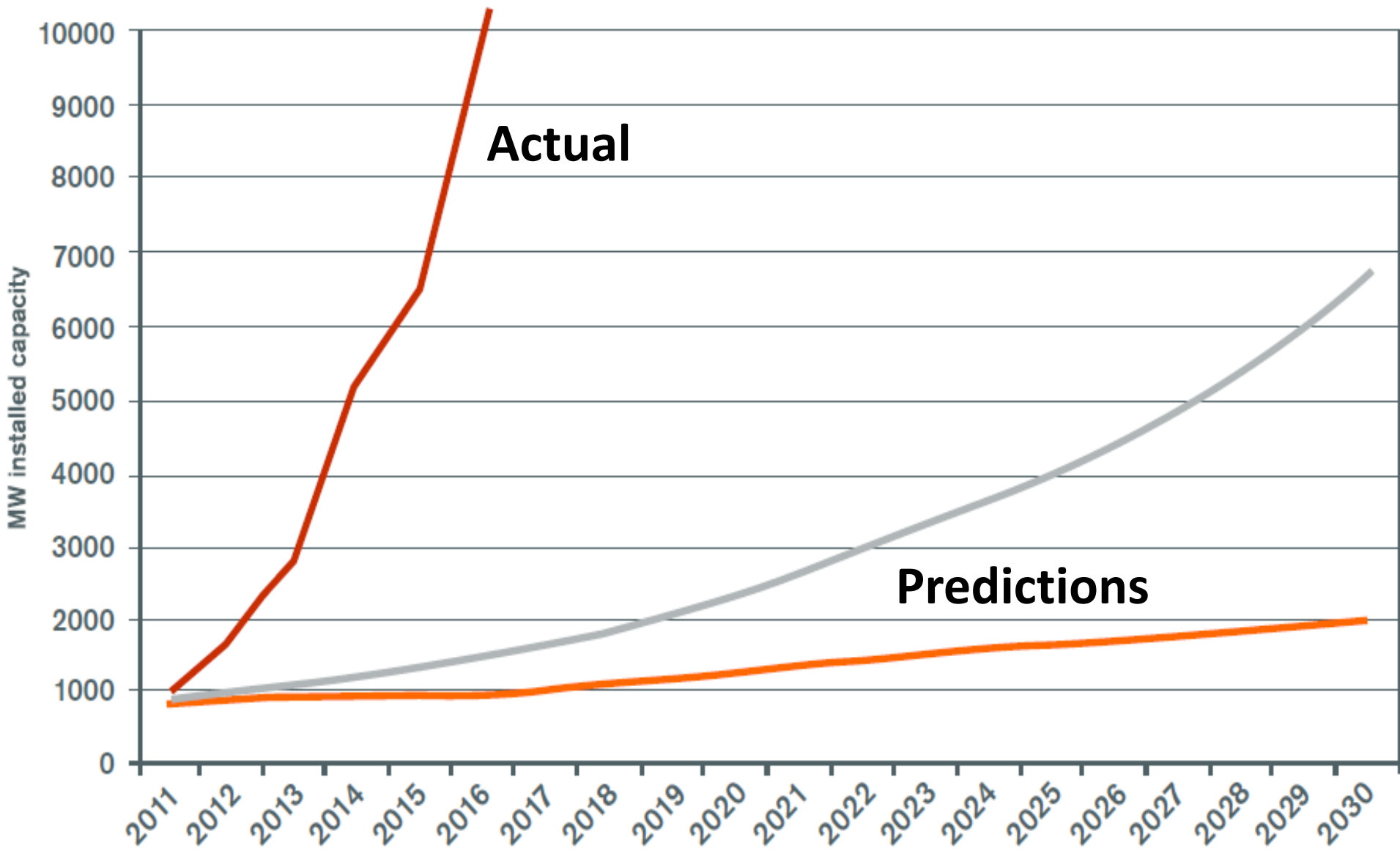
GB transmission demand

Range: 19GW minimum, 60GW peak





GB Solar growth



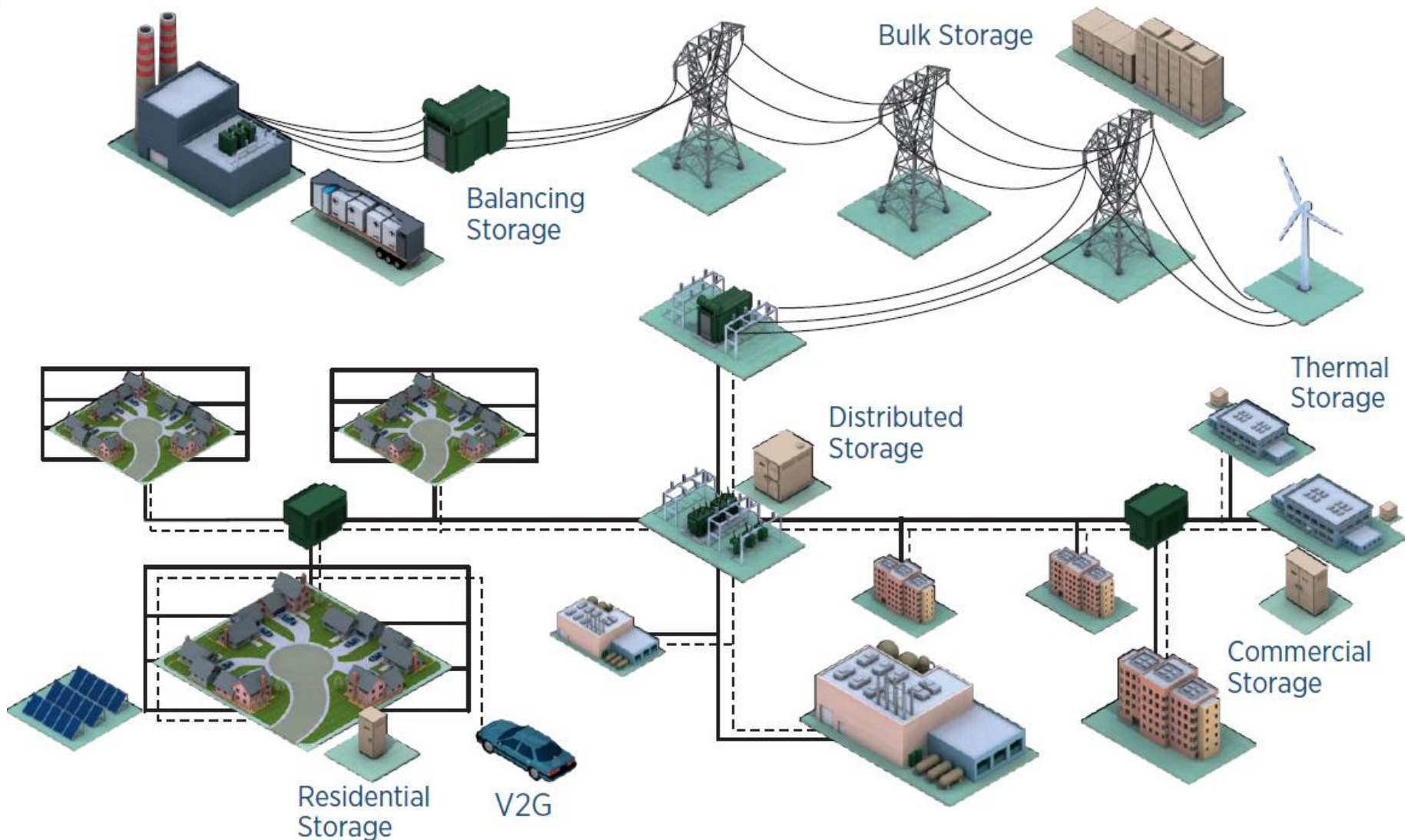


Technology

- ☐ A means to an end
- ☐ UHV/HVDC, micro-grids and all point between
- ☐ DER
- ☐ Storage
- ☐ Asset monitoring & control
- ☐ SMART; computing, data storage, data transfer capacity
- ☐ Cyber security
- ☐ Electricity vs energy vs “comfort”



Storage everywhere



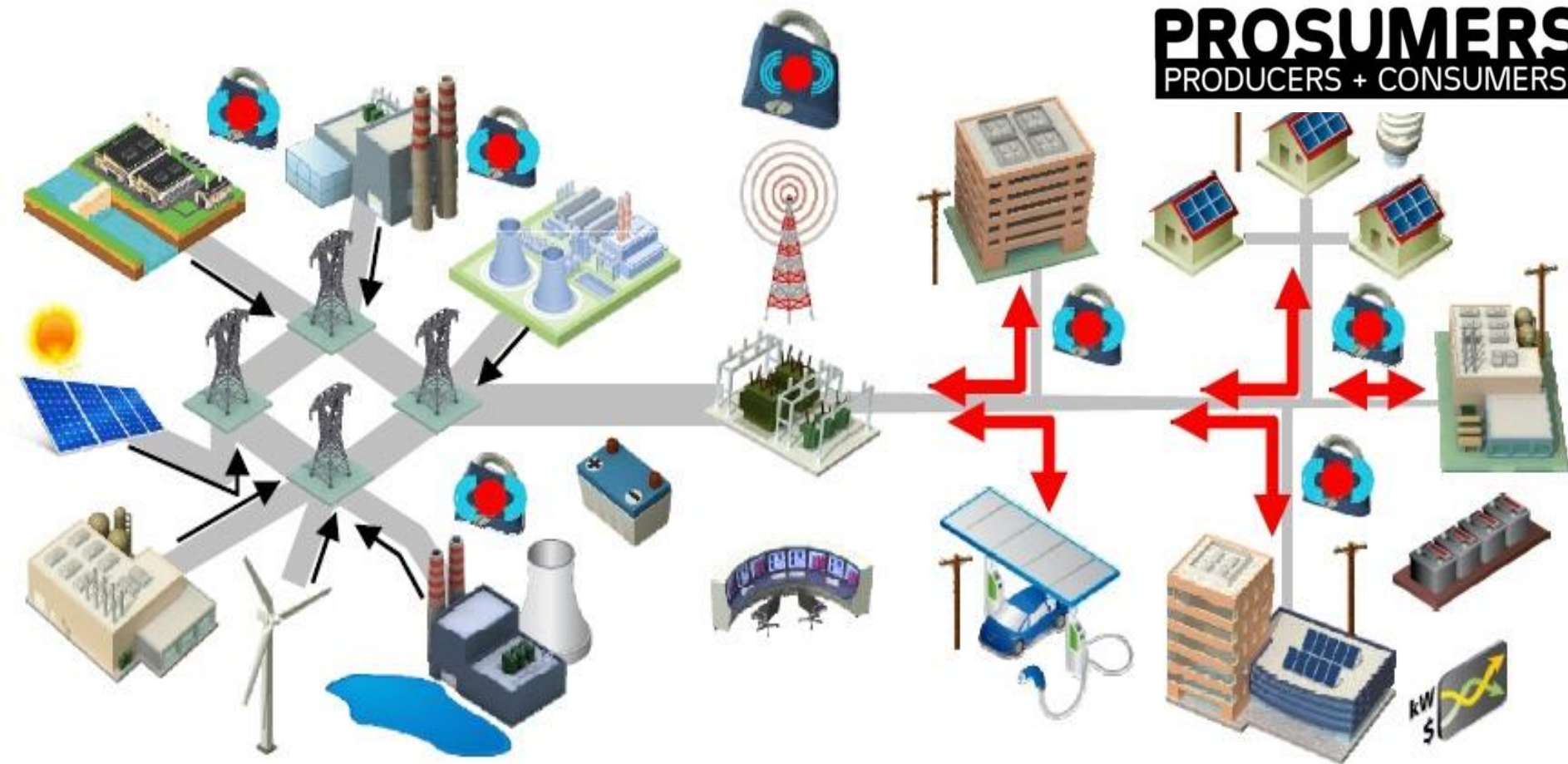
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Integrated grid



PROSUMERS
PRODUCERS + CONSUMERS



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Internet of Energy



**Sensor Fusion
Energy Grid**

*Sensors,
Actuators*



**Internet of
Energy**

*Seamless
Integration*



**Electronic
Energy Grid**

*Electronics
Computing*



**Interconnected
Energy Grid**

*Communication
Gateways*



**Software Defined
Energy Grid**

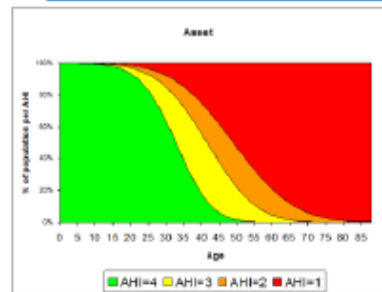
*Software Algorithms
Nano, Micro Grids*



**Cyber-Physical
Energy Grid**

*Software
Communication
Interfaces*

Asset Risk



The Asset Health Index (AHI) is a representation of the relative health of an asset.



The cost of recovery is the estimated cost of re-energising the circuit after a failure event. It varies from asset to asset and is used to compare between them.

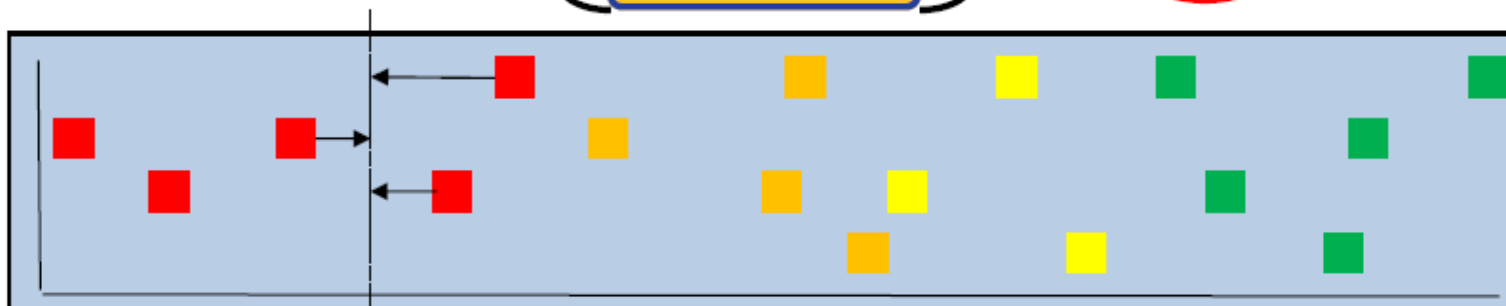


AHI

Criticality

Cost of Recovery

$$\text{AHI} \times \left\{ \begin{array}{c} \text{Criticality} \\ + \\ \text{Cost of Recovery} \end{array} \right\} = \text{Risk (£)}$$





CIGRE's present framework

- 1** ACTIVE DISTRIBUTION NETWORKS
- 2** MASSIVE EXCHANGE OF INFORMATION
- 3** INTEGRATION OF HVDC/POWER ELECTRONICS
- 4** MASSIVE INSTALLATION OF STORAGE
- 5** NEW SYSTEMS OPERATIONS /CONTROLS

- 6** NEW CONCEPTS FOR PROTECTION
- 7** NEW CONCEPTS IN PLANNING
- 8** NEW TOOLS FOR TECHNICAL PERFORMANCE
- 9** INCREASE OF UNDERGROUND INFRASTRUCTURE
- 10** NEED FOR STAKEHOLDER AWARENESS



Technical Strategy - ideas

- ❑ Clear linkage to new CIGRE Strategic Plan (CSP); especially “Power System of the Future”
- ❑ Re-focussing of the existing strategic directions along lines of:
 - **System.** Incorporating integration & interactions issues throughout the value chain
 - Opportunity to eliminate transmission vs distribution mind-set
 - **Asset.** New technologies, old technologies, re-purposing, new stresses
 - **Stakeholder.** Better definition of, and focus upon, target groups and customers and their needs
- ❑ Avoid “everything for everybody” approach
- ❑ Balance between stability and fitness for future purpose



Technical Structure

- ❑ Technological coverage (A&B Study Committees)
 - Some gaps e.g. battery & storage technologies, “end use” technology
 - Gaps can be filled to deliver against a clear vision
- ❑ Overall Study Committee structure
 - Good key process coverage (“C” committees) but (perceived) unclear boundaries and responsibilities at sub-transmission
 - CSP defines “ a suitable dedicated temporary organisation ”
 - Distribution vs “integration & interactions”; them & us mind-set
 - Aim is clear, scope & implementation to be agreed with SteerCom
 - Focus away from siloes and more effective working across the SCs
 - **Something new and more “organic”?**
 - Clarity of purpose of C6
 - C3 = D3?
- ❑ Reflect industry structure and changes



Technical Strategy Enablers

❑ Attitude, perception & language:

- Eliminate the “us & them” approach to T&D, focus on power system perspective
- Address the perception gap between what we do and what they think we do
- How aware are SC/WG members of wider CIGRE activities?

❑ Availability of time & effort:

- Be realistic about what we can deliver with volunteer resource
- Increased scope with the same resource isn't sustainable

❑ Agility & decision making:

- “Slow” organisation in an accelerating world
- Enhance existing capabilities to deliver in days/weeks **in addition to** years
- “Sometimes it is better to ask for forgiveness than permission”; Risk vs benefit

❑ Sales & marketing:

- Reach out and tell people, don't wait for them to ask
- Build CIGRE role as instigator of relevant research



Your thoughts?