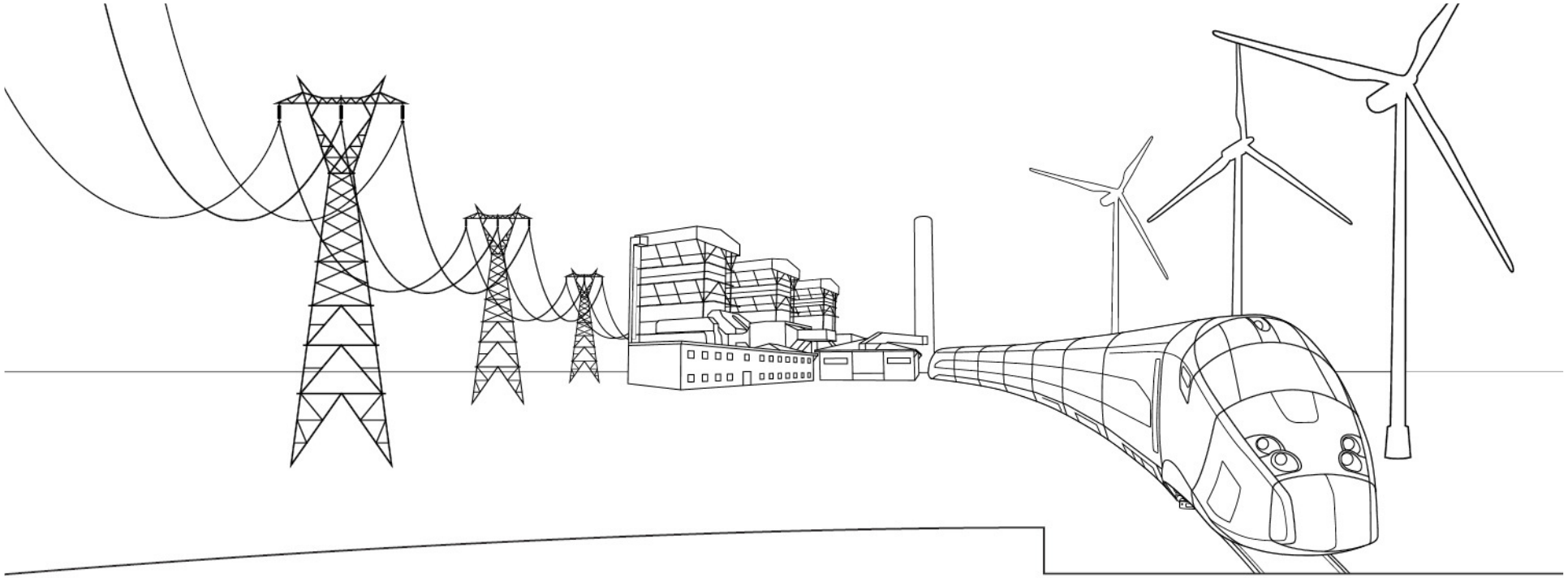

Global Power System Transformation

- Evolutionary, Revolutionary, Exponential -

Dr. Lawrence Jones
Vice President, Utility Innovations & Infrastructure Resilience
Alstom Grid, North America

Joint Institute for Strategic Energy Analysis
Golden, CO
March 11, 2015

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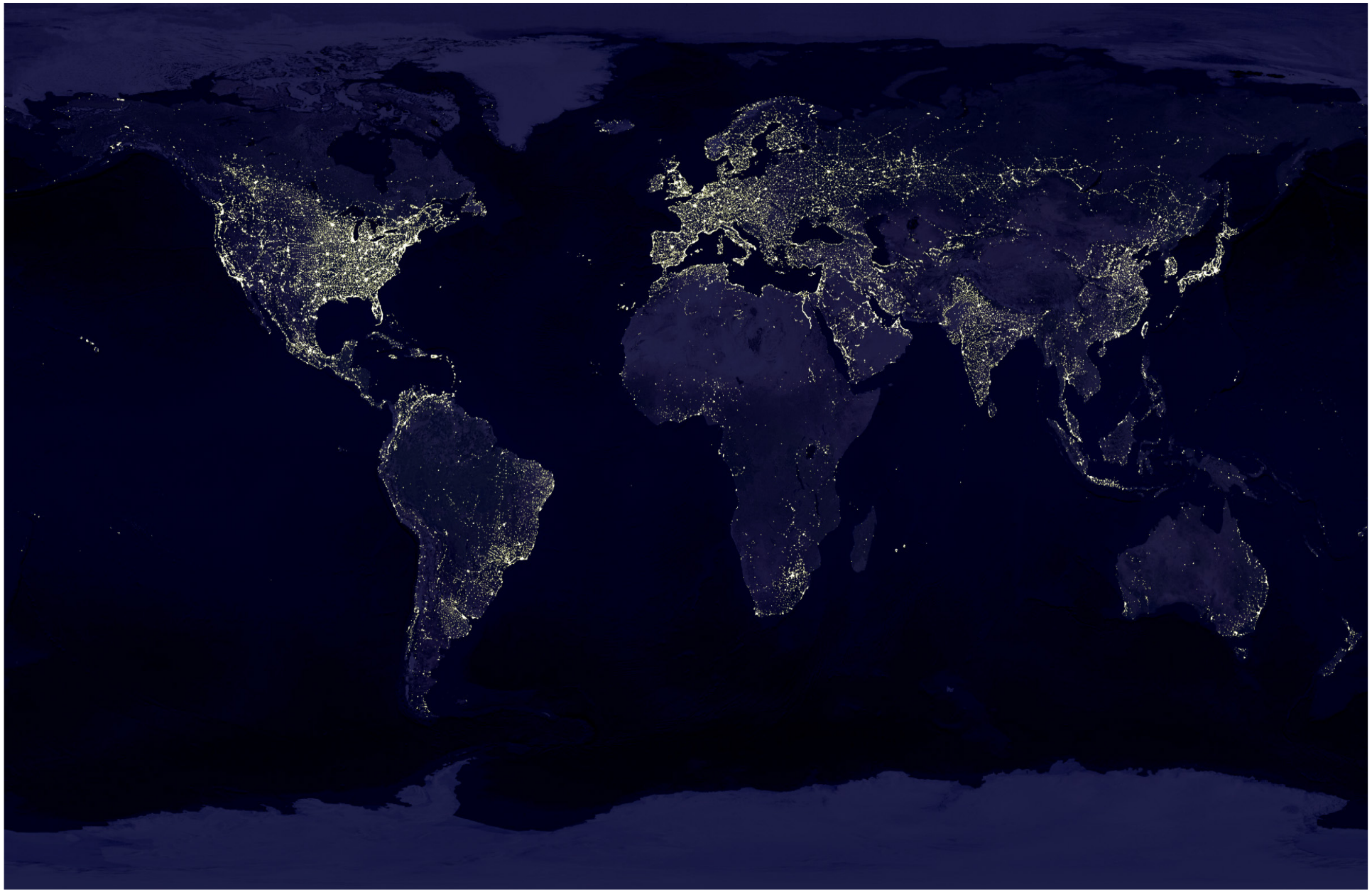
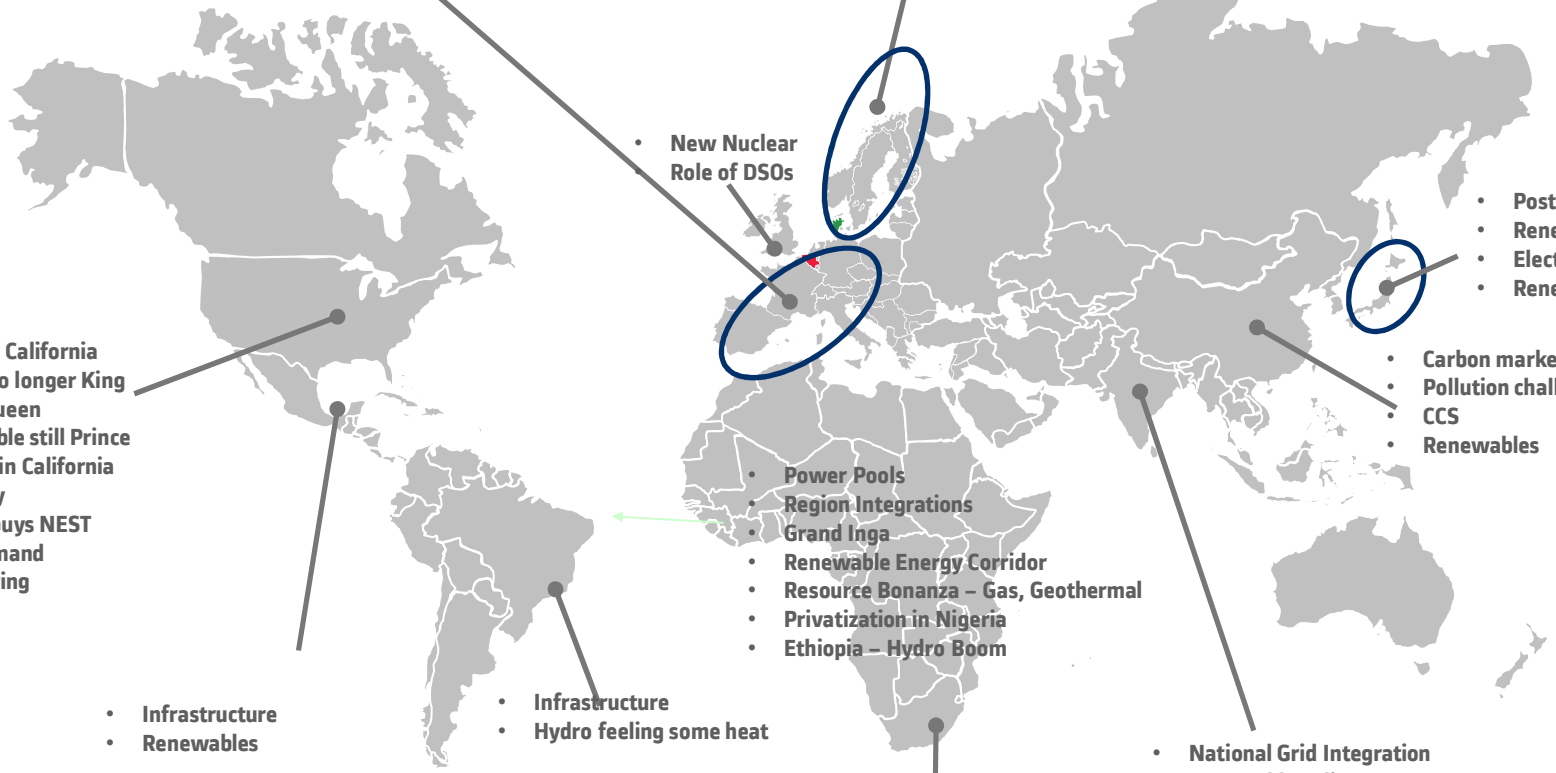
Shaping the future

Our Energy Divided World @ “Night”, March 11, 2015



How will this look likein 2020, 2030 & 2050?

Electricity Systems and Markets Around the Globe At a Glance



- Energiiwende
- Single Electricty Europeen Market
- Renewable challenges
- Role of DSOs

- Nordpool evolution
- HVDC Interconnectors
- Single Electric Retail Market
- Denmark's C02 Policy

- New Nuclear
- Role of DSOs

- Post Fukashima
- Renewables
- Electricity Markets
- Renewables

- NY REV, California
- Coal is no longer King
- Gas is Queen
- Renewable still Prince
- Storage in California
- SolarCity
- Google buys NEST
- Low Demand
- Netmetring

- Carbon markets
- Pollution challenges
- CCS
- Renewables

- Power Pools
- Region Integrations
- Grand Inga
- Renewable Energy Corridor
- Resource Bonanza – Gas, Geothermal
- Privatization in Nigeria
- Ethiopia – Hydro Boom

- Infrastructure
- Renewables

- Infrastructure
- Hydro feeling some heat

- National Grid Integration
- Renewable policy
- Rural electrification
- Micro Grids

- Capacity shortage
- Renewable growth
- Aging Infrastructure
- IPP Programs
- Unbundling
- CCS

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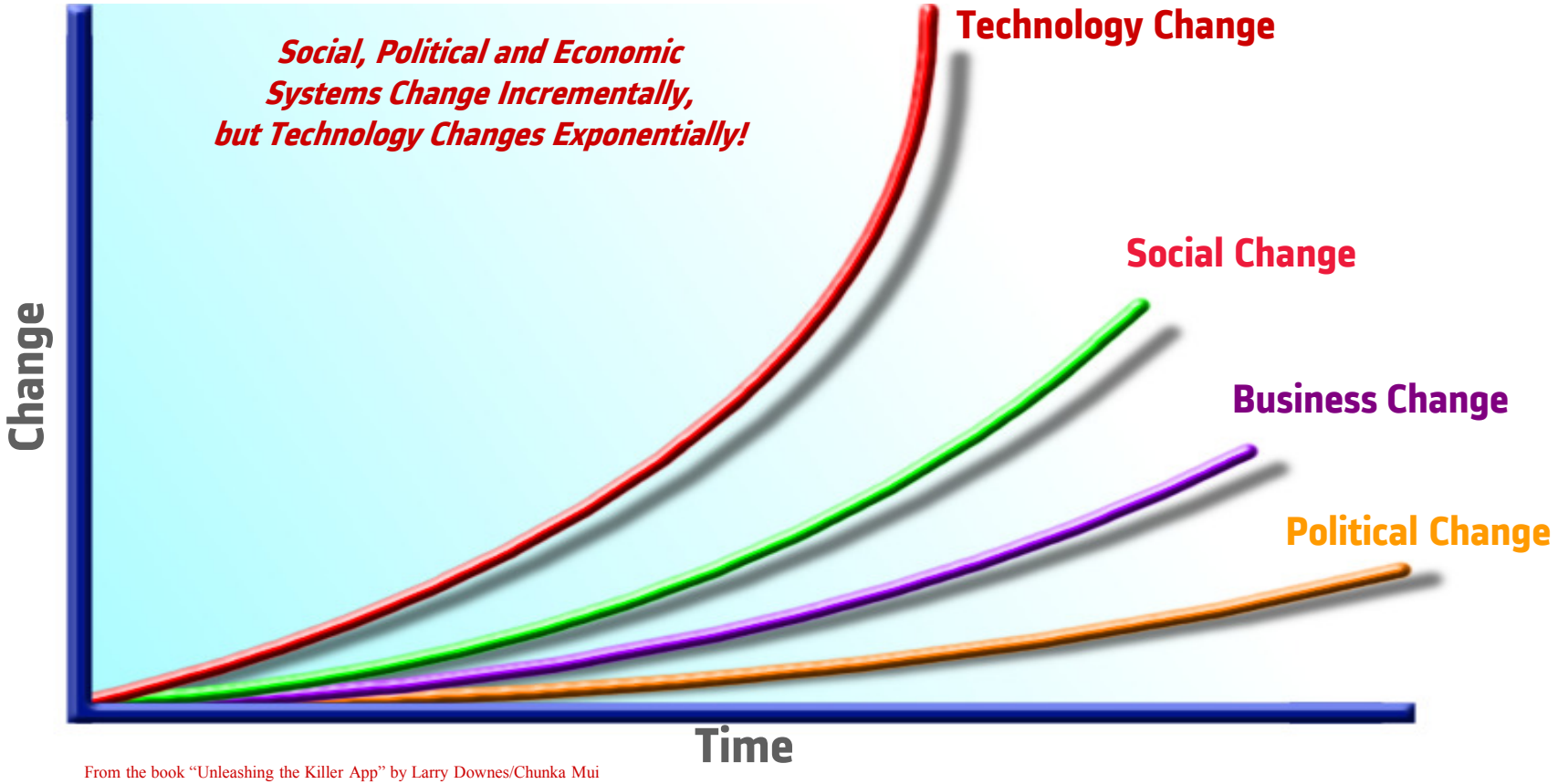
Political, Business, Social and Technology Changes



From the book "Unleashing the Killer App" by Larry Downes/Chunka Mui

Need for Regulatory Leapfrogging

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Exponential Framework & Global Power System Transformation

- Digitalization
- Deception
- Disruption
- Demonitization
- Dematerialization
- Democratization

Source: Bold – How to Go Big, Create Wealth and Impact the World. Peter Diamandis and Steven Kotler, 2015

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Disruption of the Energy Value Chain
-*Flexibility, Diversity, & Empowerment* –

- **“Converging technologies offer new options for customers but challenge the business assumptions of established companies”**
Larry Downes, The Laws of Disruption

-

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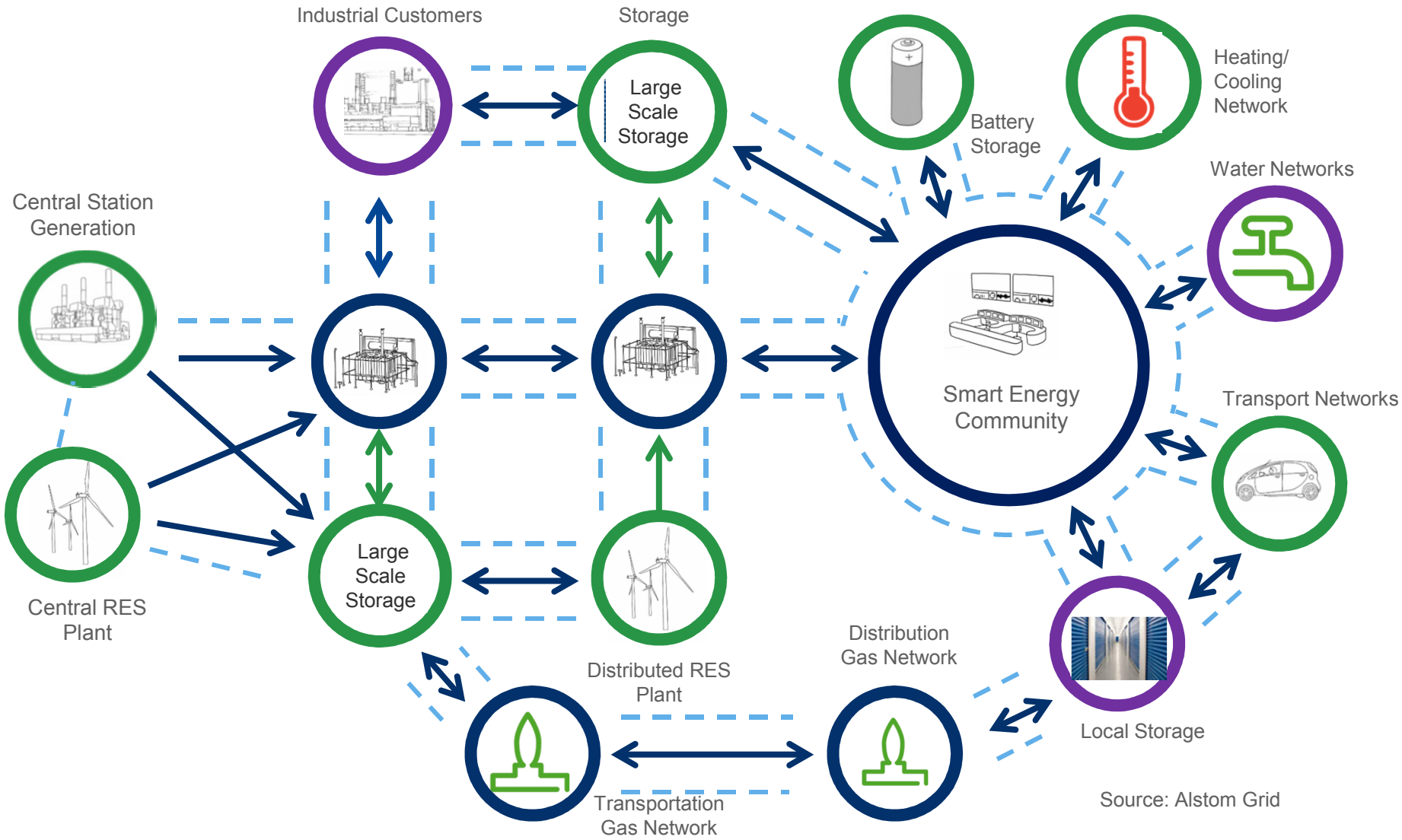
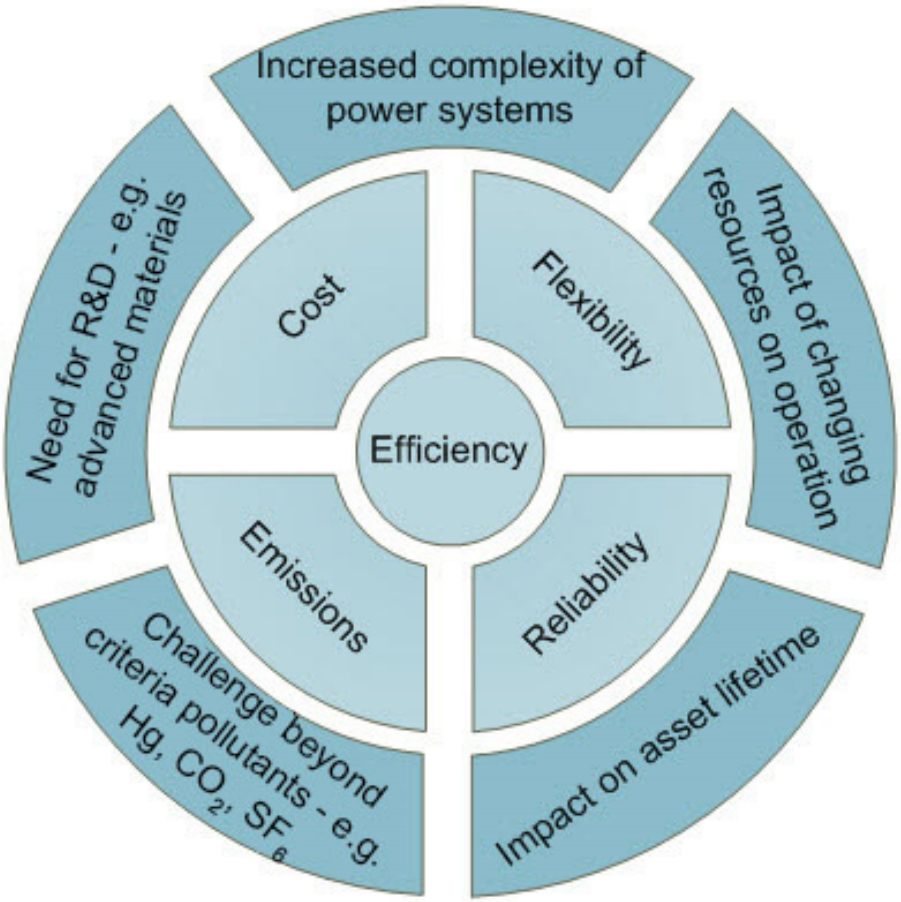
Maximize Benefits of Interdependent Infrastructures



Source: Alstom Grid

Power System Transformation – Convergence of Issues

The Trade-offs



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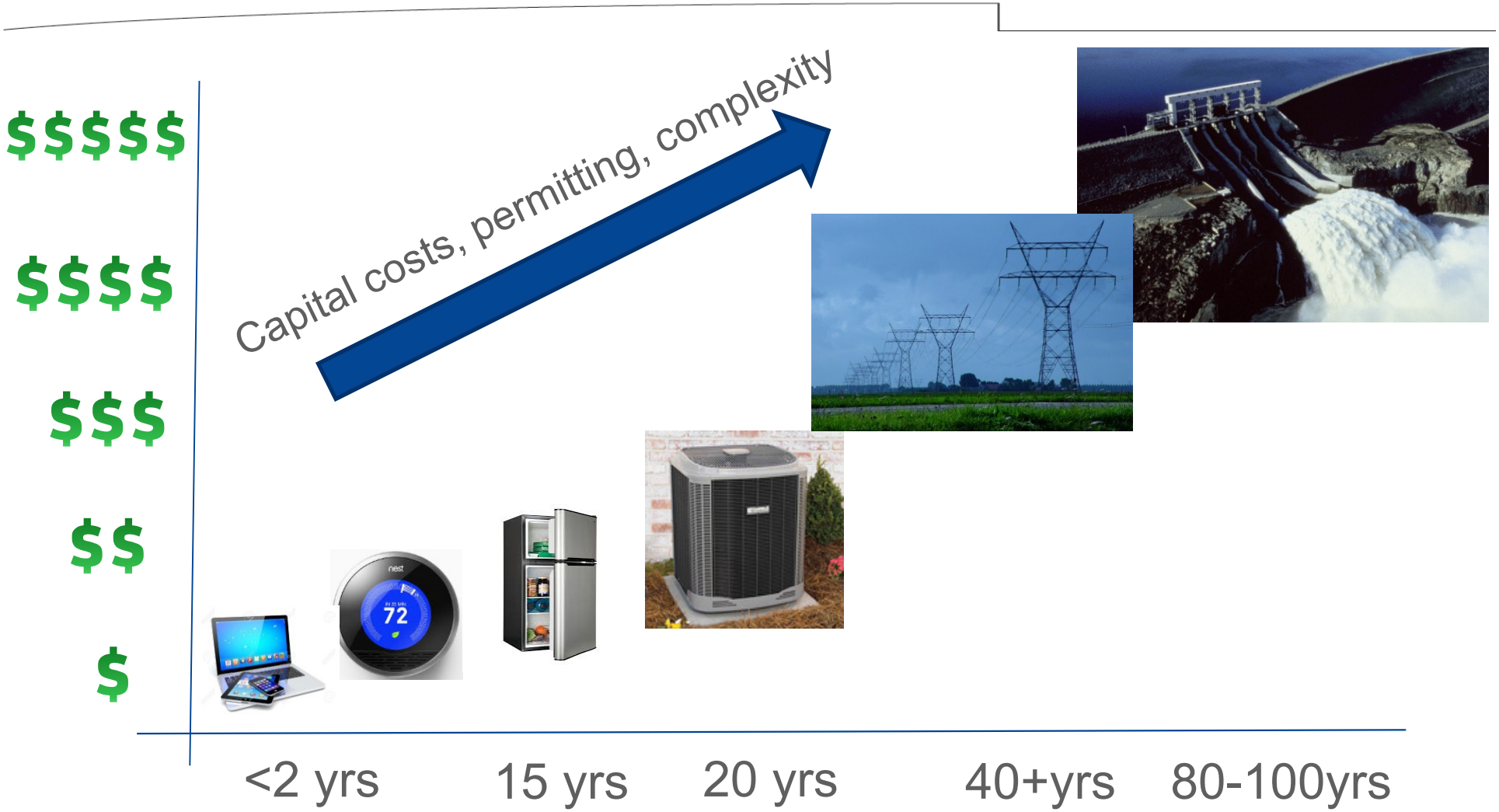
Why will some transformation take longer than others?



PRECEIVED USEFUL ECONOMIC LIFE vs. CAPITAL COST

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Extracting Value from Convergence

IT – OT - MT

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The Transformation is Inevitable.
Will it be
Evolutionary, Revolutionary or Exponential?

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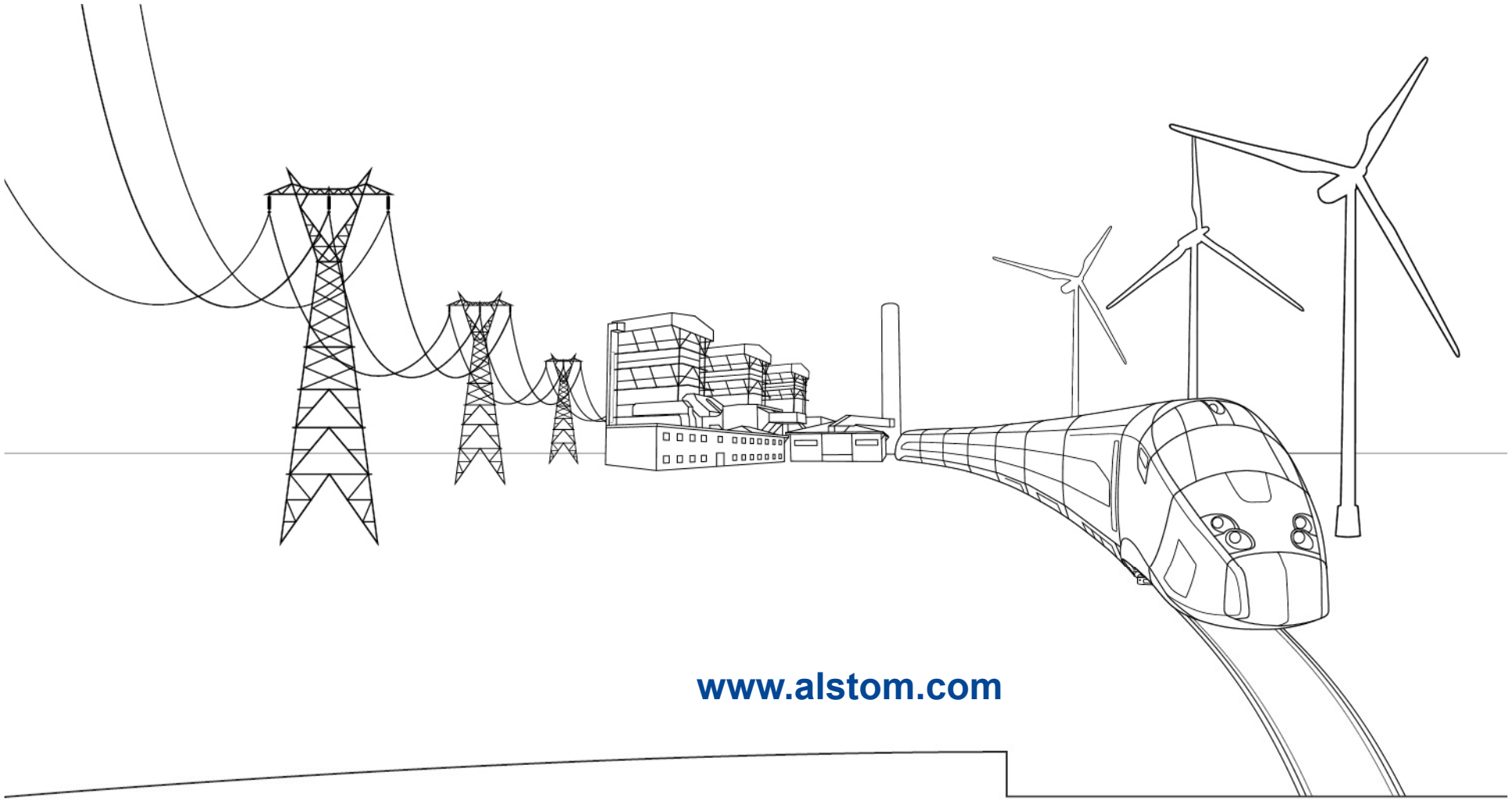

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