



EirGrid Group Customer Conference 2012

25th October 2012

Delivering the Power System of tomorrow



Electricity Research Centre

Mark O'Malley

25th October, 2012

EirGrid Customer Conference

www.ucd.ie/erc



Greatest Engineering Achievements OF THE 20TH CENTURY

◆ About ◆ Timeline ◆ The Book

Welcome!

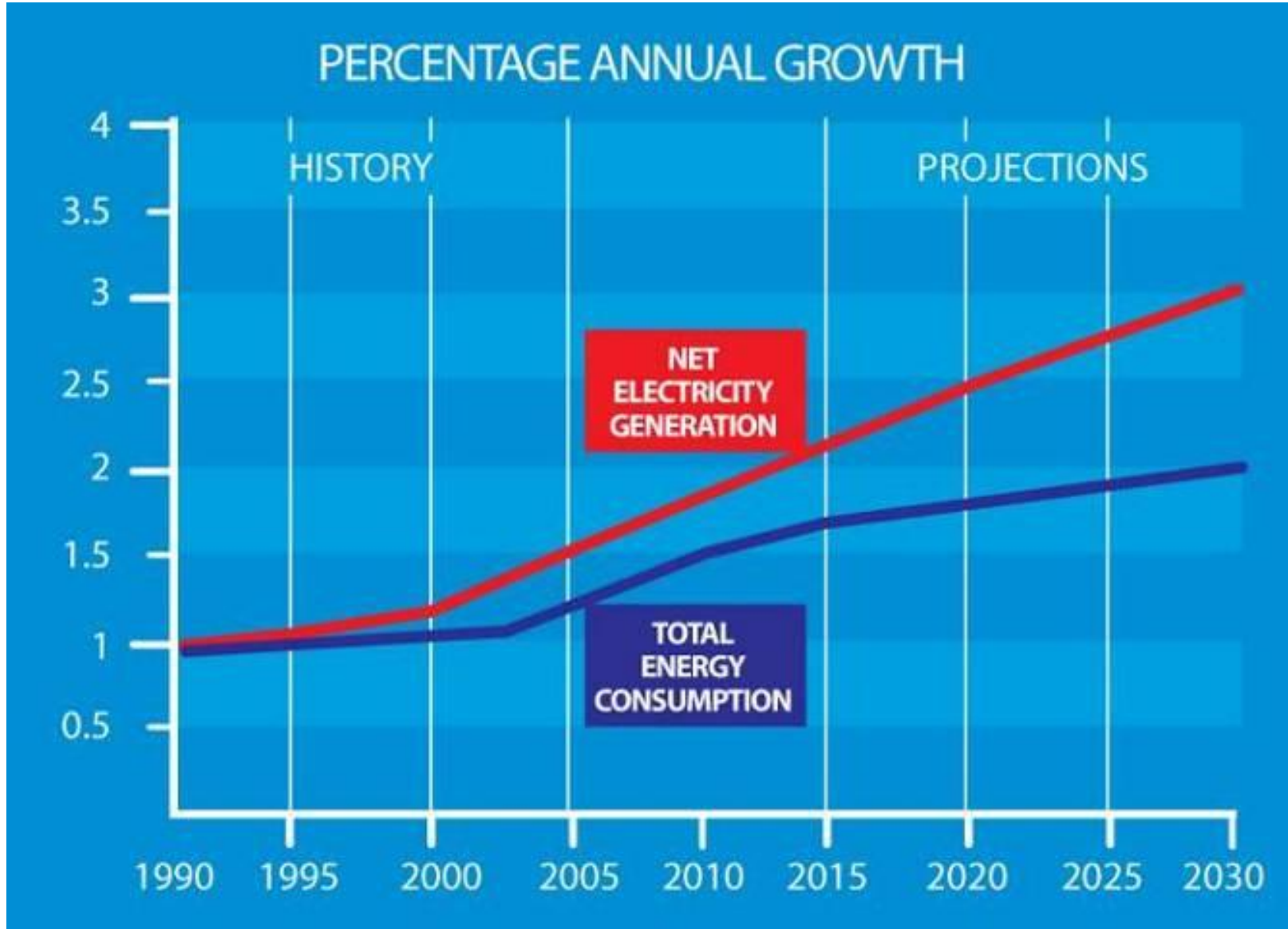
How many of the 20th century's greatest engineering achievements will you use today? A car? Computer? Telephone? Explore our list of the top 20 achievements and learn how engineering shaped a century and changed the world.

- | | |
|--|--|
| 1. Electrification | 11. Highways |
| 2. Automobile | 12. Spacecraft |
| 3. Airplane | 13. Internet |
| 4. Water Supply and Distribution | 14. Imaging |
| 5. Electronics | 15. Household Appliances |
| 6. Radio and Television | 16. Health Technologies |
| 7. Agricultural Mechanization | 17. Petroleum and Petrochemical Technologies |
| 8. Computers | 18. Laser and Fiber Optics |
| 9. Telephone | 19. Nuclear Technologies |
| 10. Air Conditioning and Refrigeration | 20. High-performance Materials |

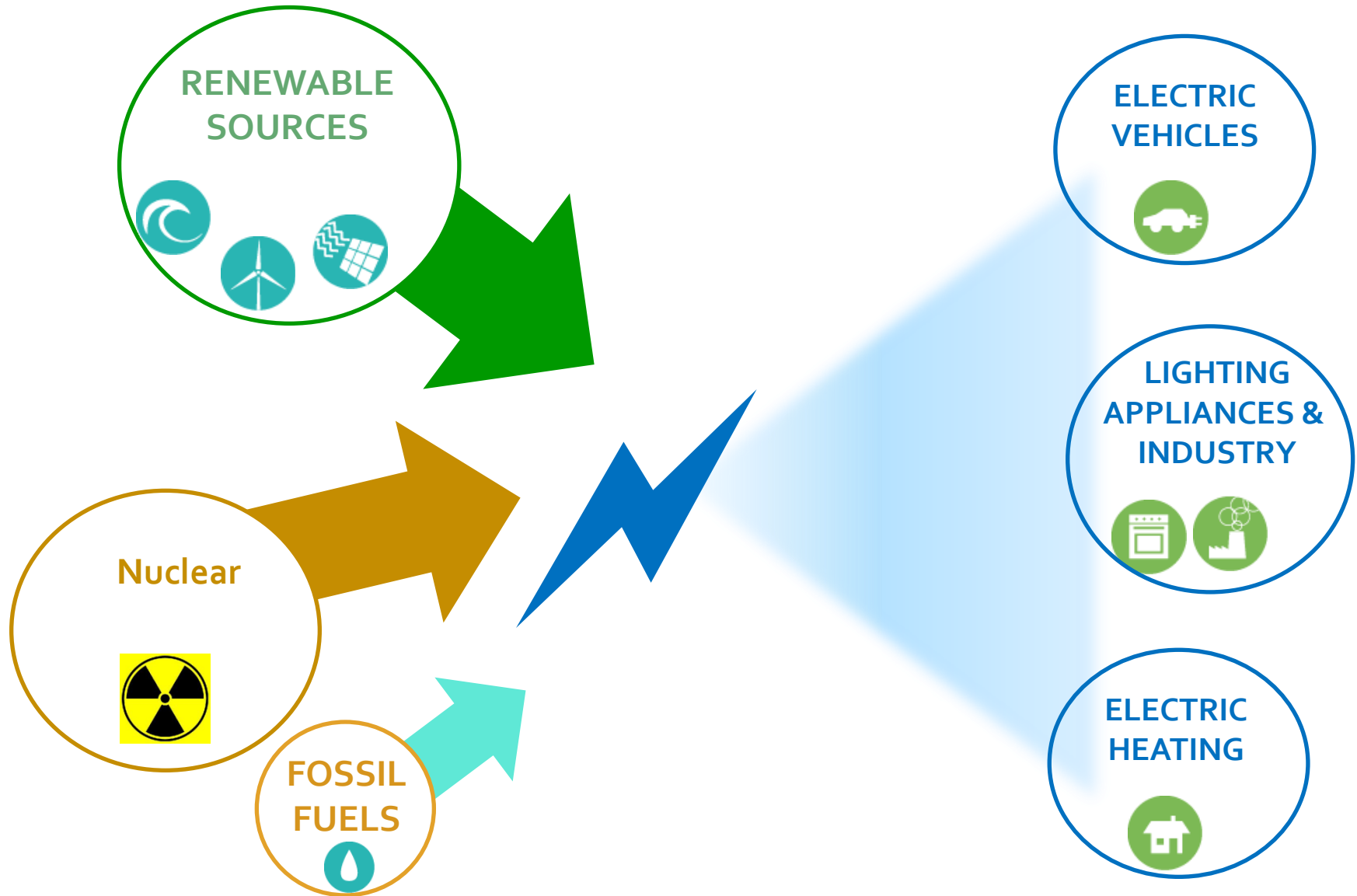


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The energy future is electric



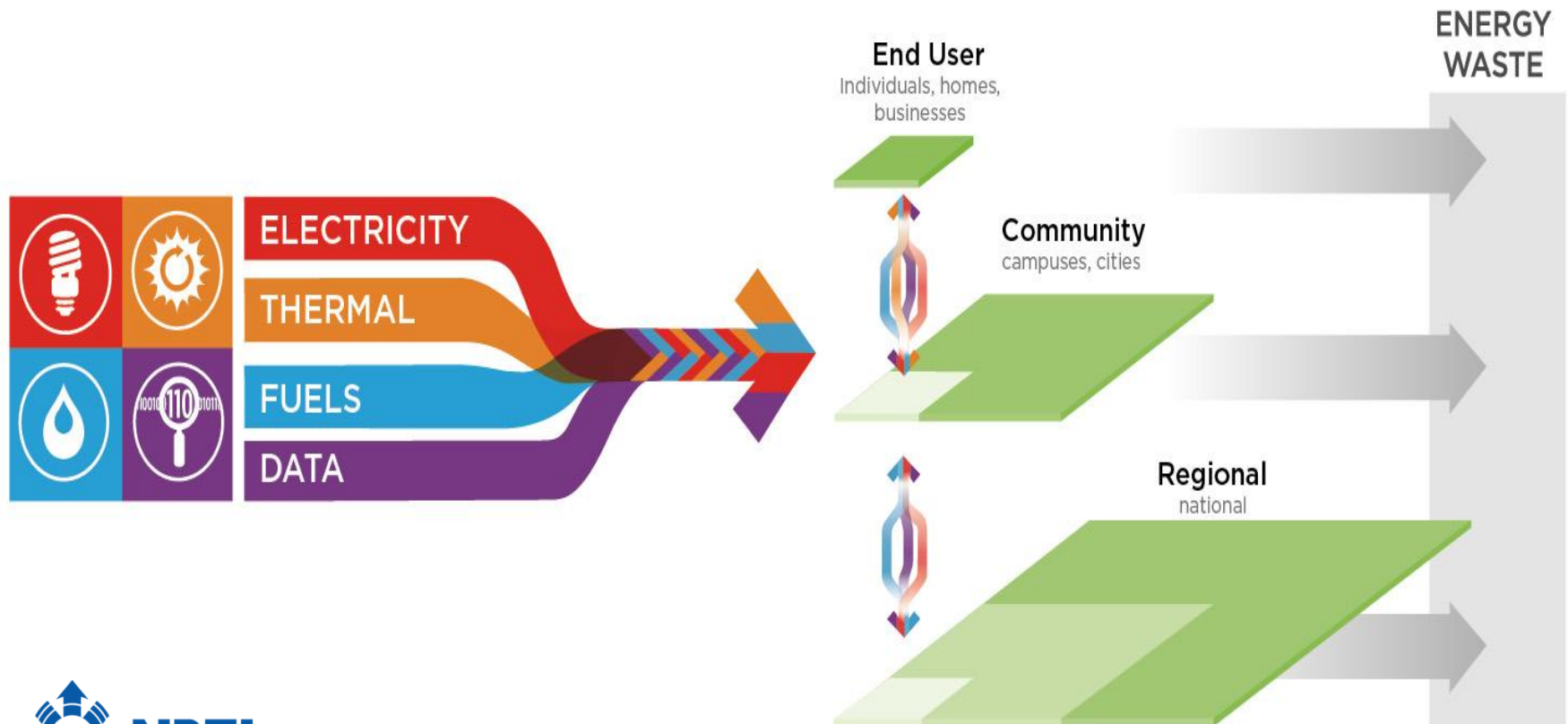
Convergence on electricity

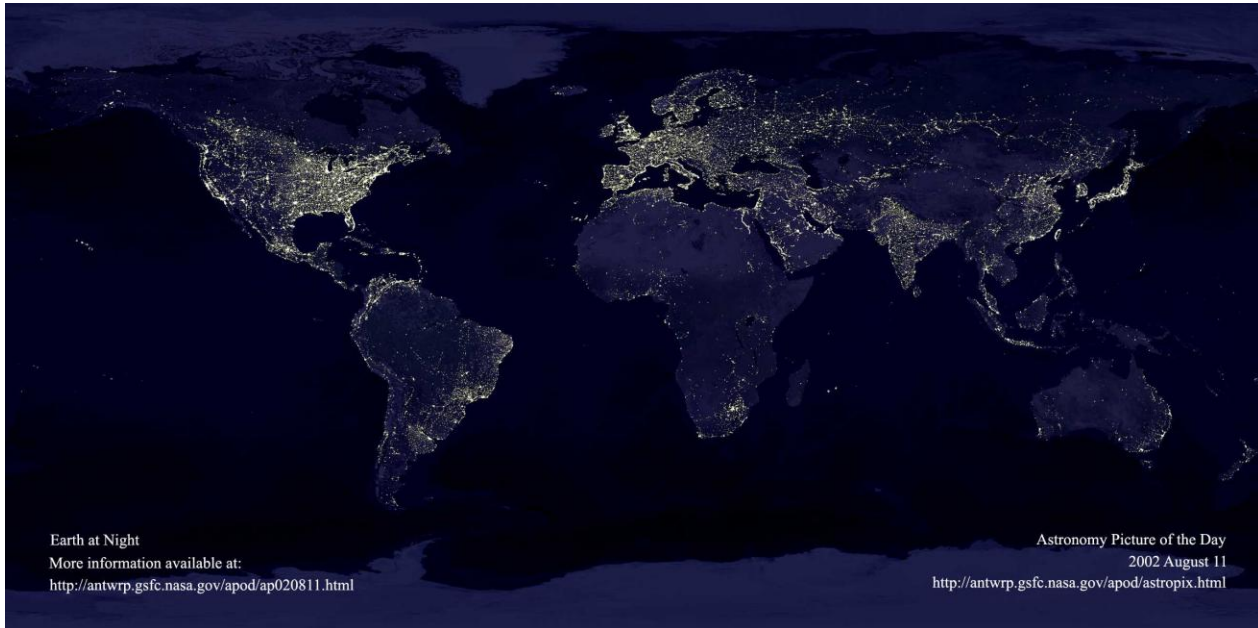




ESI

Energy Systems Integration (ESI)
optimizes the design and performance of
electrical, thermal, and fuel pathways at all scales.





Earth at Night
More information available at:
<http://antwrp.gsfc.nasa.gov/apod/ap020811.html>

Astronomy Picture of the Day
2002 August 11
<http://antwrp.gsfc.nasa.gov/apod/astropix.html>

Local & International Collaboration



Ireland's EU Structural Funds Programmes 2007 - 2013
Co-funded by the Irish Government and the European Union



An Roinn Fiontar, Trádála agus Nuálaíochta
Department of Enterprise, Trade and Innovation



IOWA STATE UNIVERSITY



Risø DTU

<http://erc.ucd.ie>

International Convergence

□ ERC Membership

- Summer students



□ USA

- Department of Energy
- National Renewable Energy Laboratory



□ China

- Energy Foundation
- International Energy Agency (IEA) Task 25
- Tsinghua





NREL's Energy Systems Integration Facility



Addressing the challenges of large-scale integration of clean energy technologies into the energy systems infrastructure.

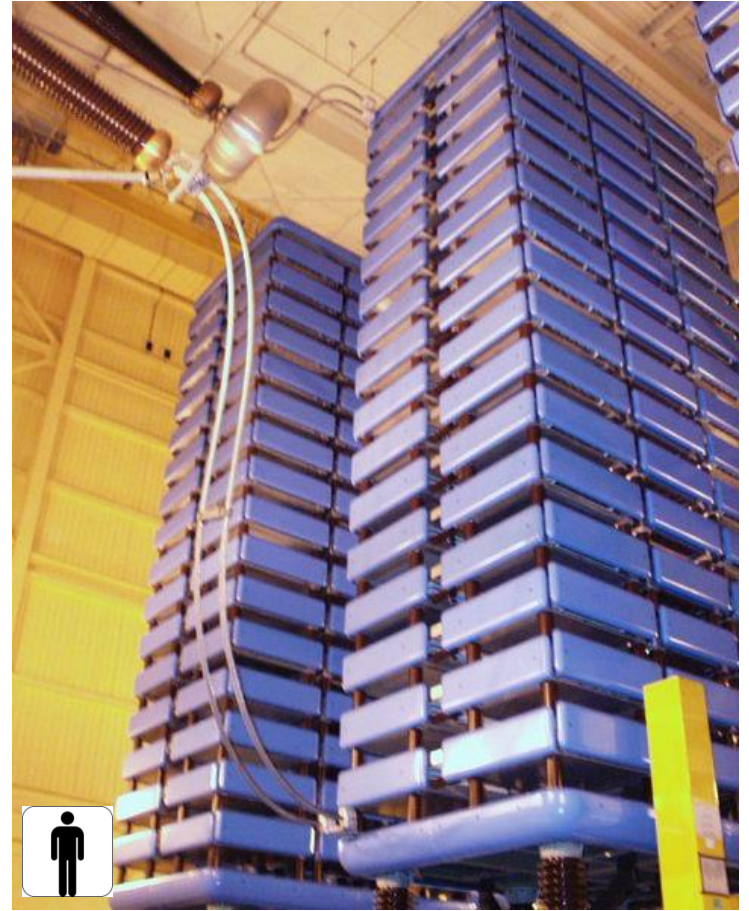


http://www.nrel.gov/eis/facilities_esif.html



Smart Grid Innovation Hub

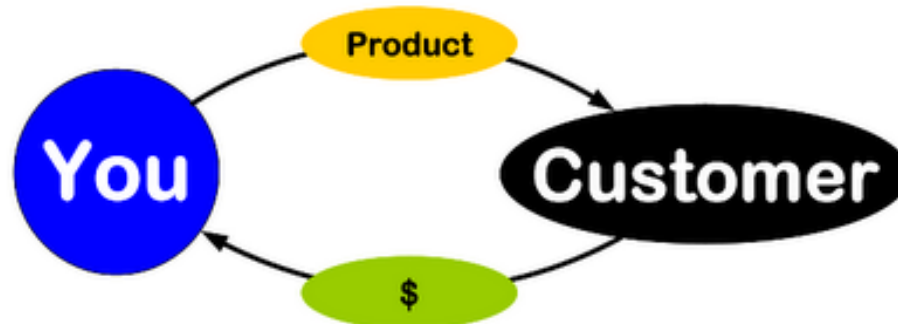






Is there a “killer app” in electricity?

Teenage girls changed the world





erc
electricity research centre

Some of our work, ideas & commercial impact

**Smart Grid
Innovation Hub**



semo
Single Electricity
Market Operator

SONi
Smart Centre for Northern Ireland

NDRC



<http://erc.ucd.ie/realtimedata/historic.php>

erc real-time data

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Download Data: [ROI Demand: Max, Min, Average](#) [ROI Wind: Max, Min, Average](#) [GB Demand: Max, Min, Average](#) [GB Wind: Max, Min, Average](#)

Units: MW	1 Year		3 Months		30 Days	
	Min	Max	Min	Max	Min	Max
Demand Ireland	1,561 <small>08/10/2011 04:15</small>	4,640 <small>13/12/2011 17:30</small>	1,678 <small>04/06/2012 05:45</small>	3,757 <small>25/04/2012 18:00</small>	1,678 <small>04/06/2012 05:45</small>	3,605 <small>07/06/2012 17:45</small>
Wind Ireland	2 <small>06/06/2012 08:30</small>	1,474 <small>26/11/2011 19:30</small>	2 <small>06/06/2012 08:30</small>	1,406 <small>29/04/2012 12:45</small>	2 <small>06/06/2012 08:30</small>	1,260 <small>22/06/2012 16:15</small>

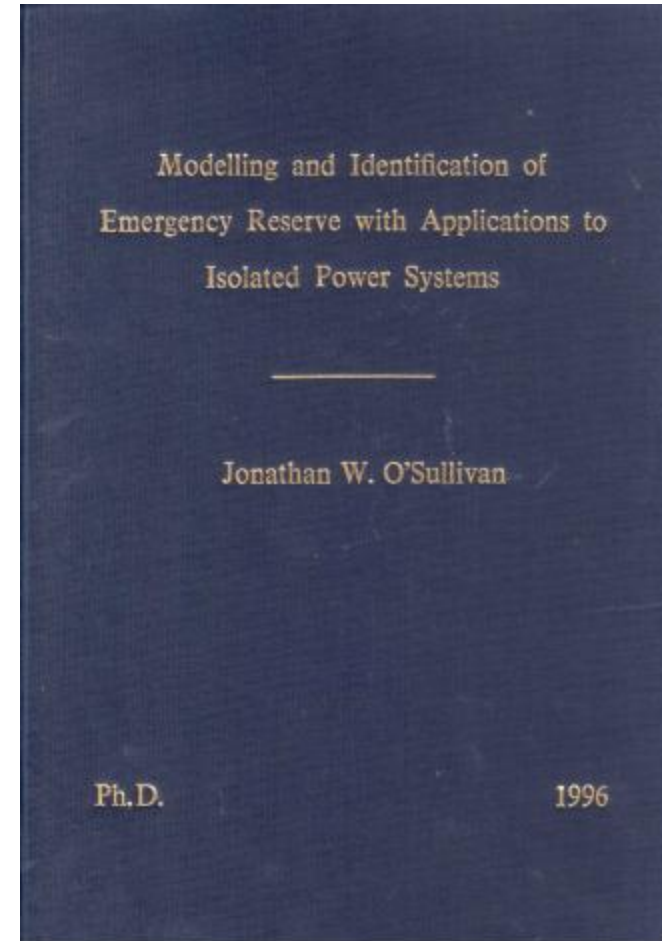
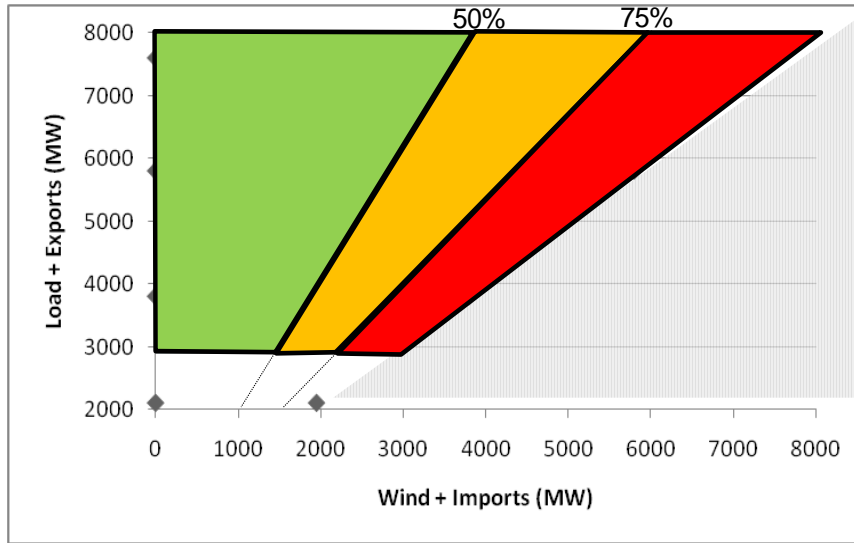
Notes on Data

Values quoted represent the recorded maximum and minimum values for wind generation and system demand in the Republic of Ireland and Great Britain for up to a year previous to *today*.

Times are given in local time.

All values are in MW.

Commercialisation of Skills and Knowledge



The pipeline



Careers in
Industry!

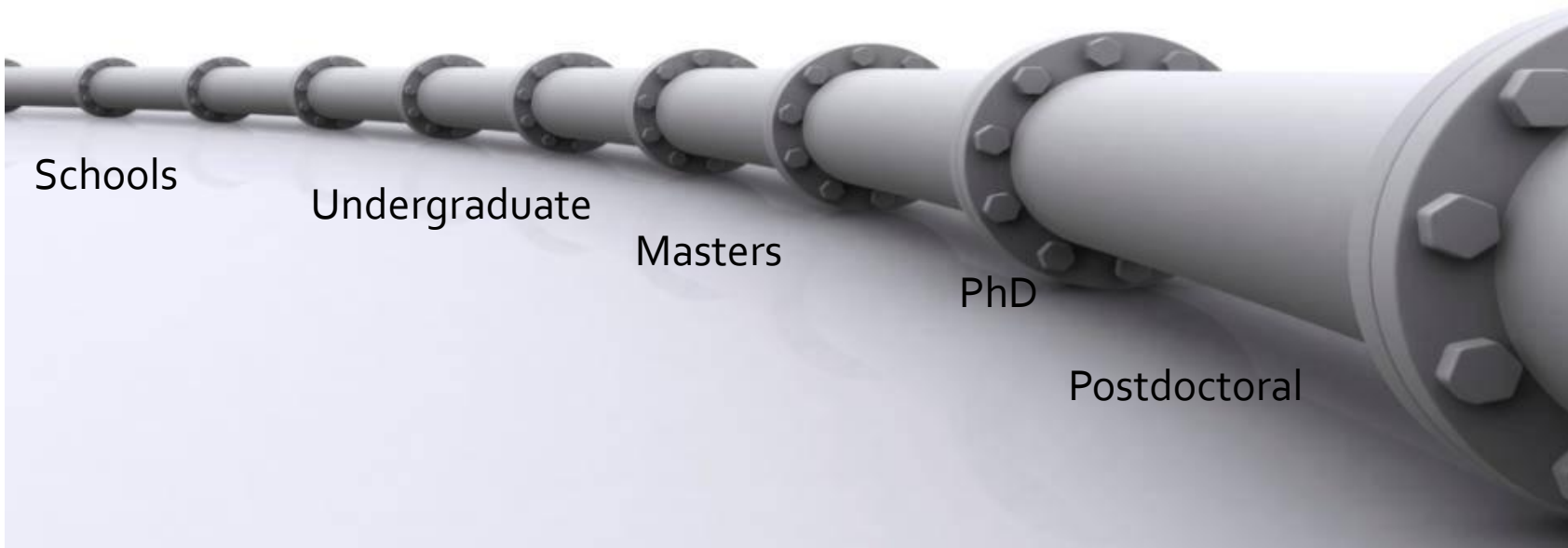
Schools

Undergraduate

Masters

PhD

Postdoctoral

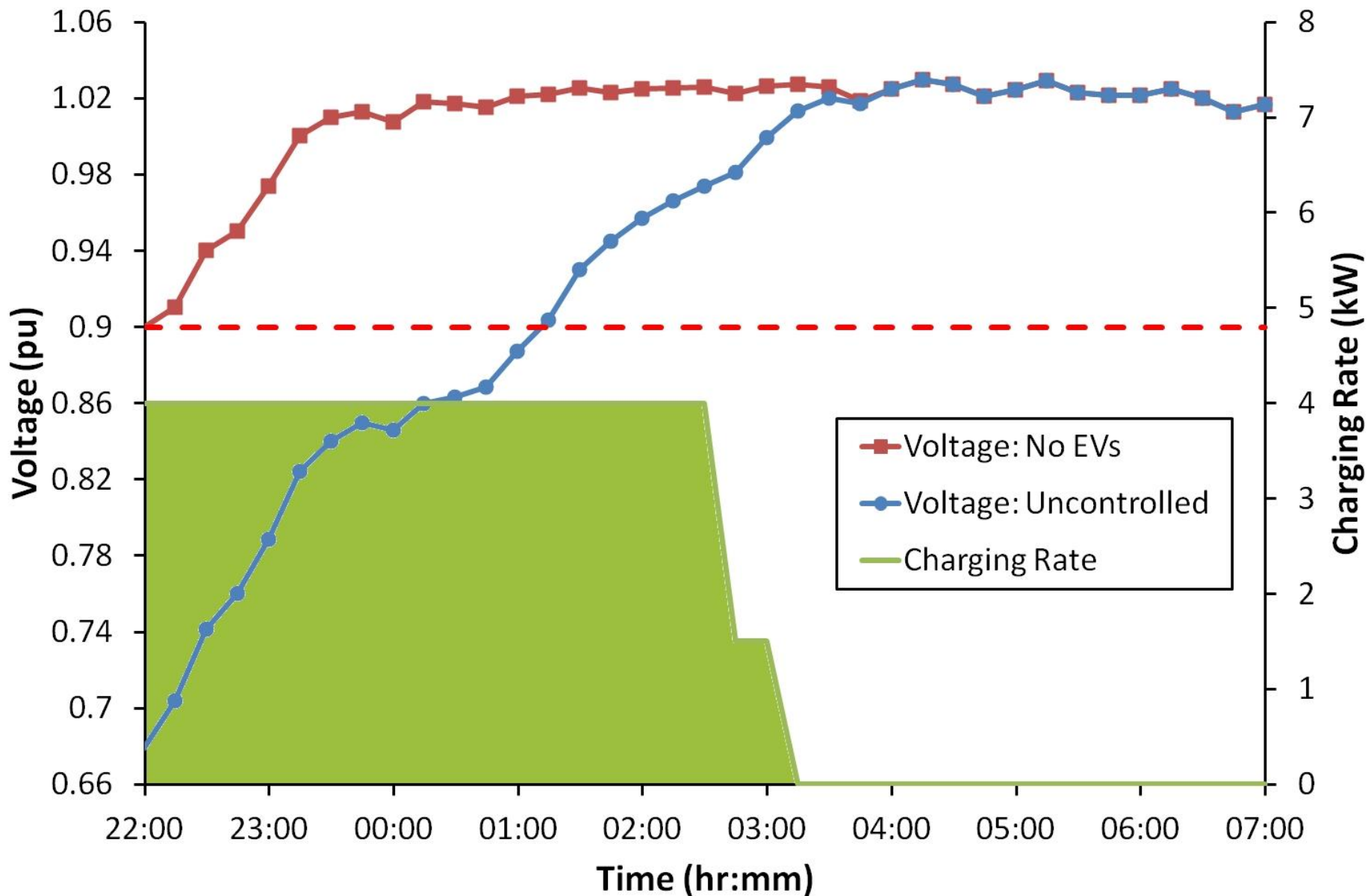


Integration of Distributed Energy Resources in Low Voltage Electricity Networks

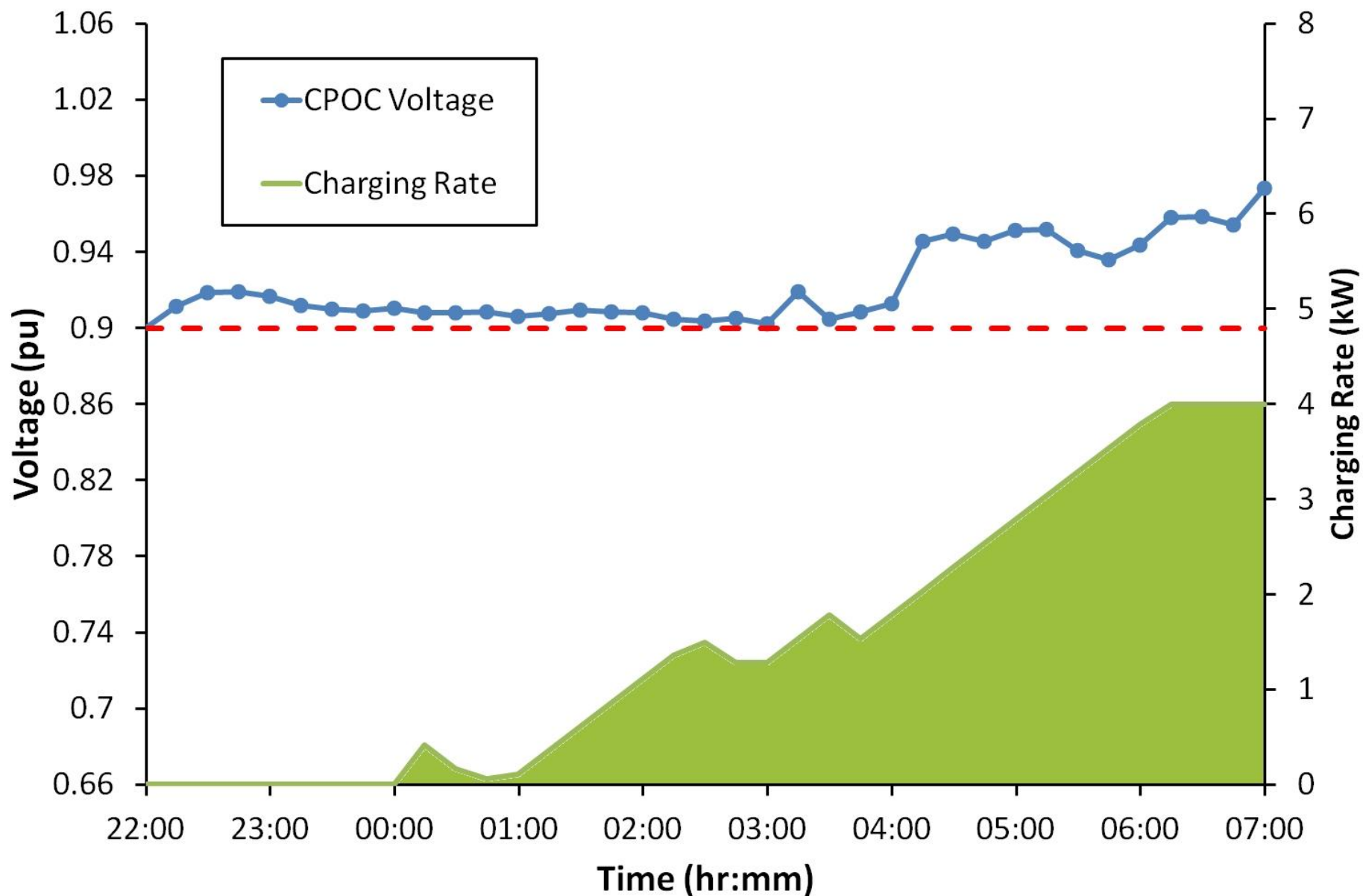
Dr. Peter Richardson



Uncontrolled Charging of EVs



Controlled Charging of EVs

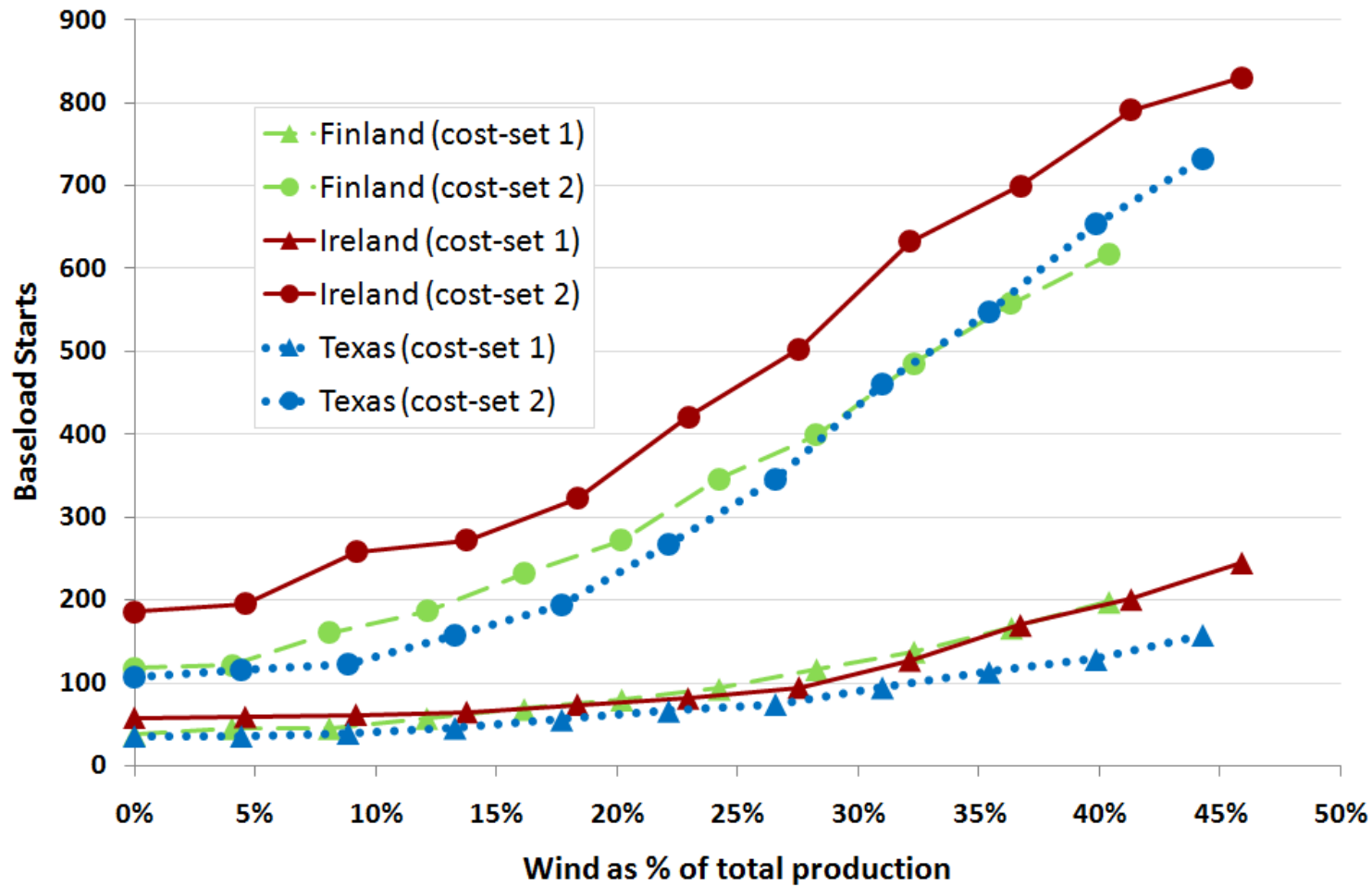


The Future Grid: Quantifying & Responding to Variability

Mr. Aonghus Shortt



Base load starts: unit commitment versus simple models



Shortt, A., Kiviluoma, J. and O'Malley, M., "Accommodating Variability in Generation Planning", *IEEE Transactions on Power Systems*, in press, 2012

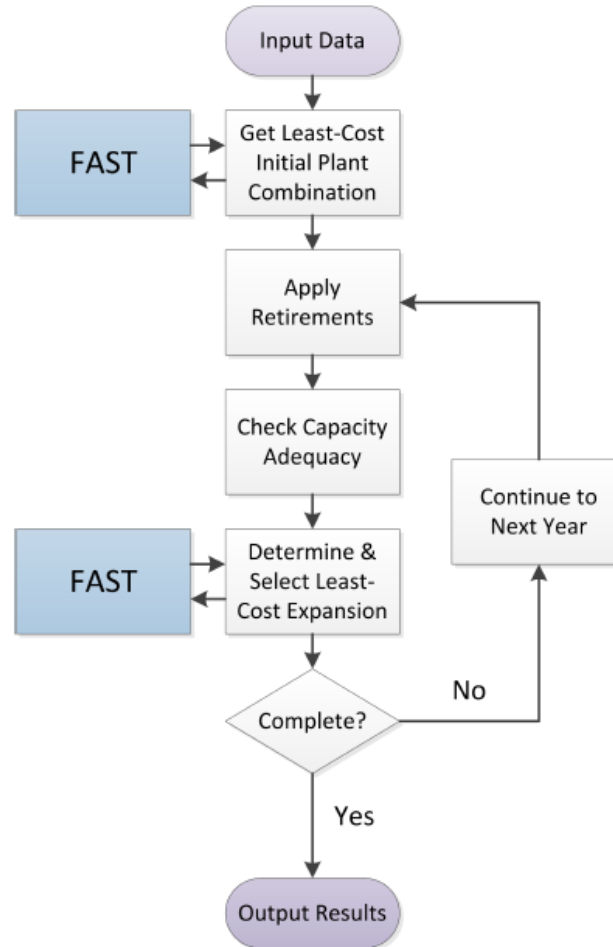


Fig. 1: High-level flow chart broadly outlining the capacity expansion methodology.

A. Shortt and M.J. O'Malley, "Quantifying Long-Term Impact of Electric Vehicles", *IEEE Transactions on Smart Grid*, in review, 2012.

Evolving plant mix

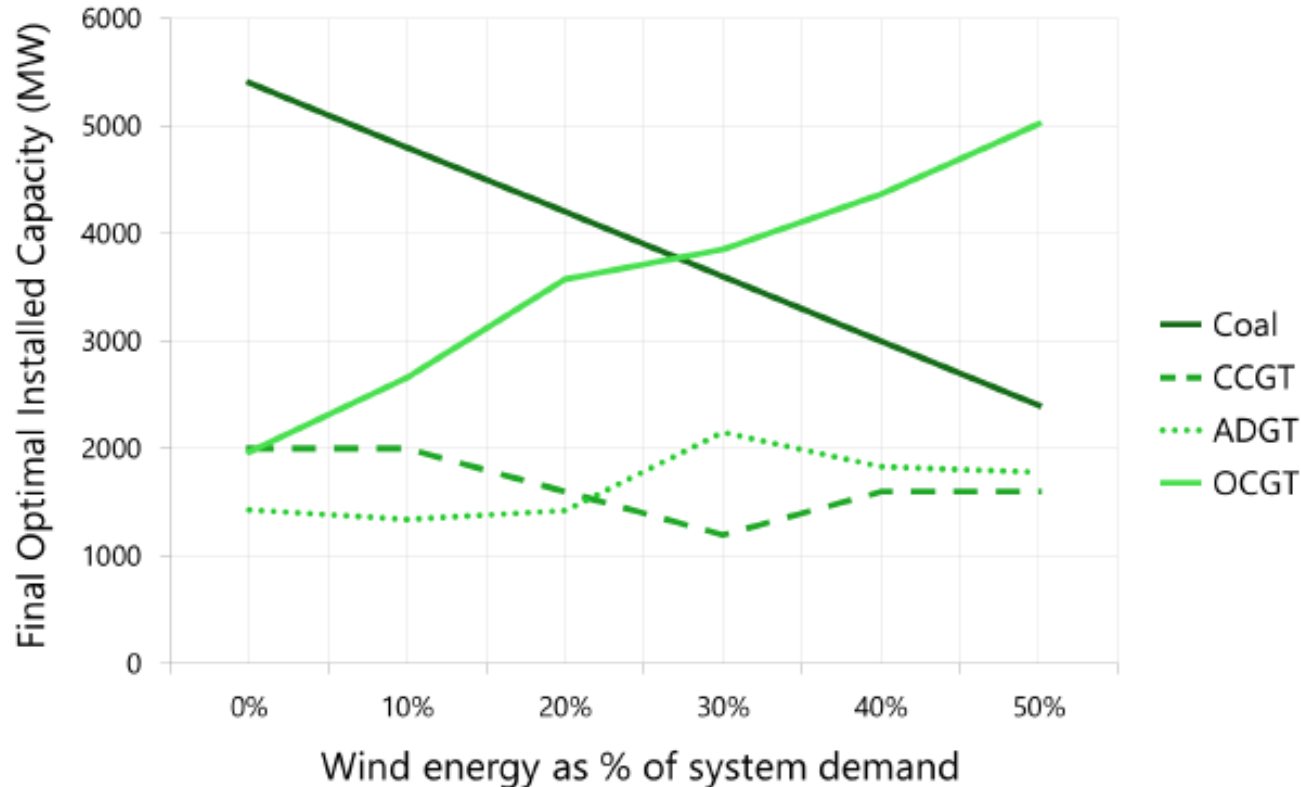


Fig. 11: Final levels of installed plant for increasing levels of installed wind (Sweden, 5% EV penetration, €0 CO_2 cost).

A. Shortt and M.J. O'Malley, "Quantifying Long-Term Impact of Electric Vehicles", *IEEE Transactions on Smart Grid*, in review, 2012.



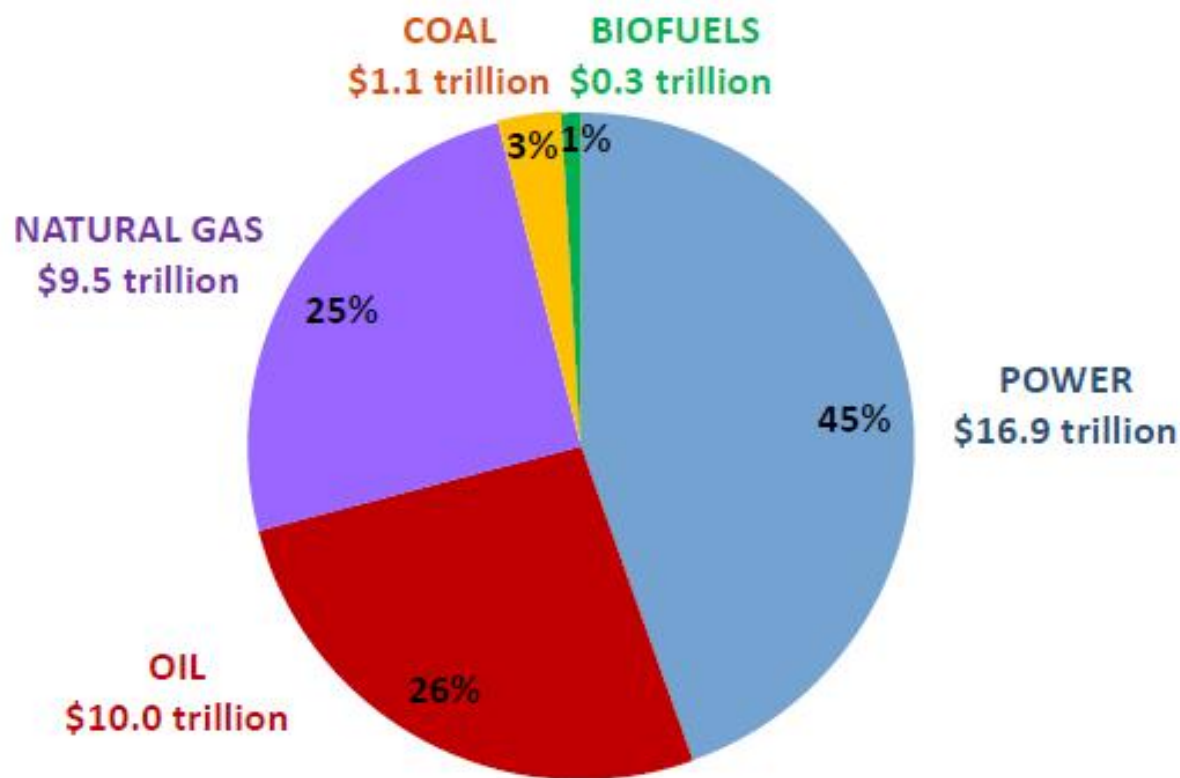
The opportunity

**Smart Grid
Innovation Hub**



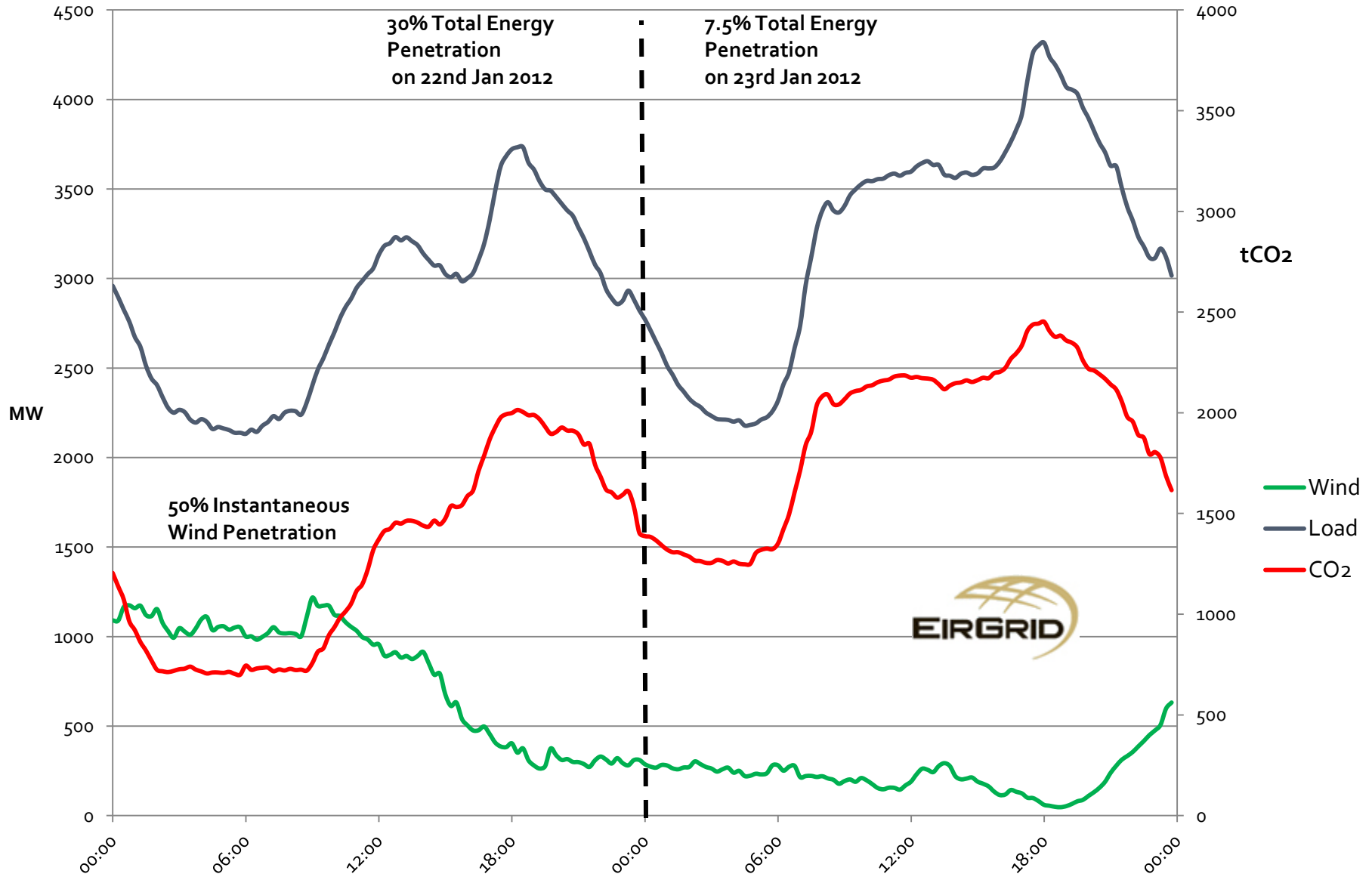
Investment: the essence of energy

Cumulative investment in energy infrastructure, 2011-2035

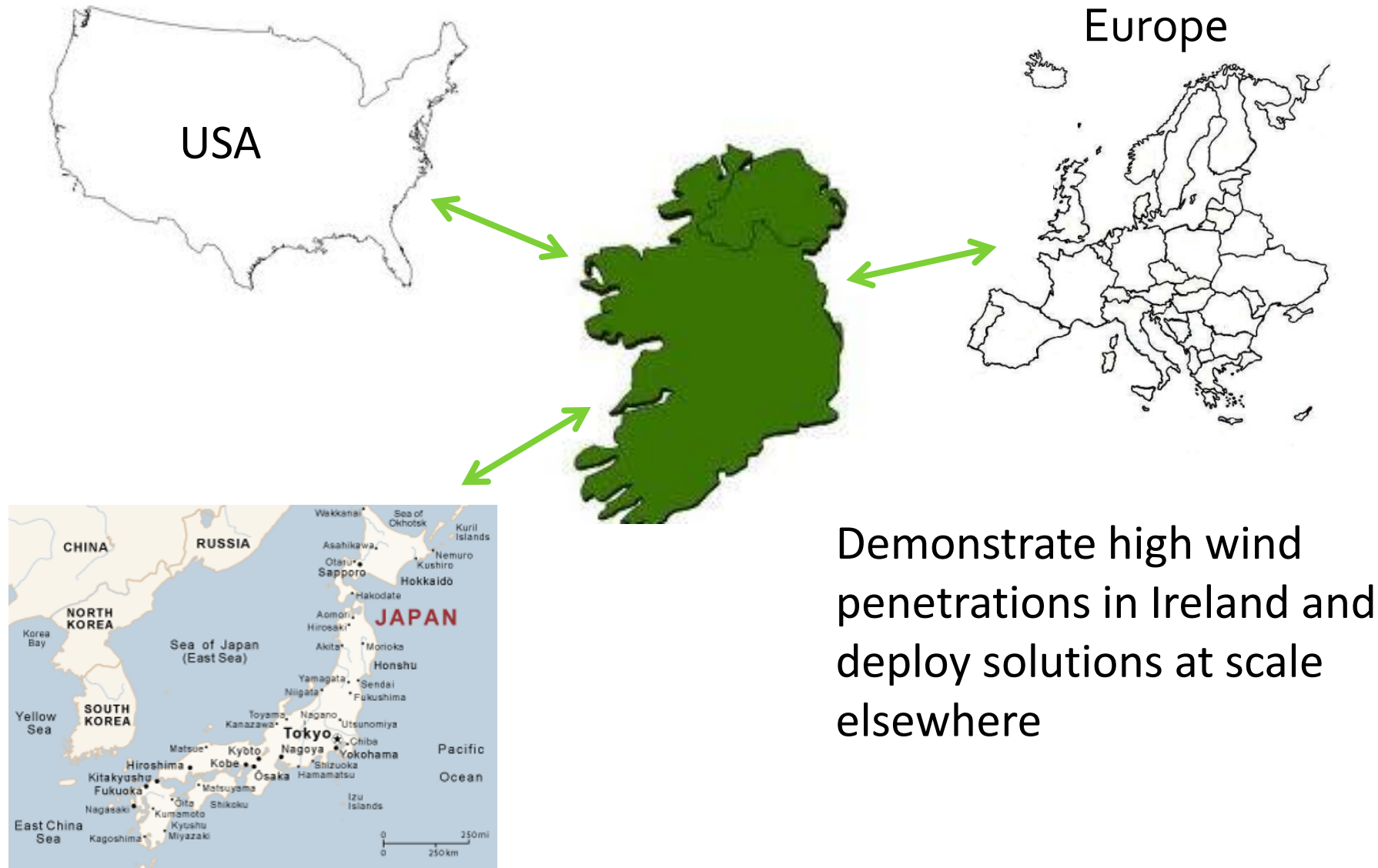


WEO-2011 will show that \$38 trillion of investment is required to meet projected energy demand through to 2035 and that investors in energy projects are facing a multitude of risks

Load, Wind and CO₂ Republic of Ireland



Ireland, an exemplar for the world



Unique



.....what we do have are a very particular set of skills; skills we have acquired over a very long career....



Contact us



alan.taylor@ucd.ie

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