



Developing a model of the Irish energy-system

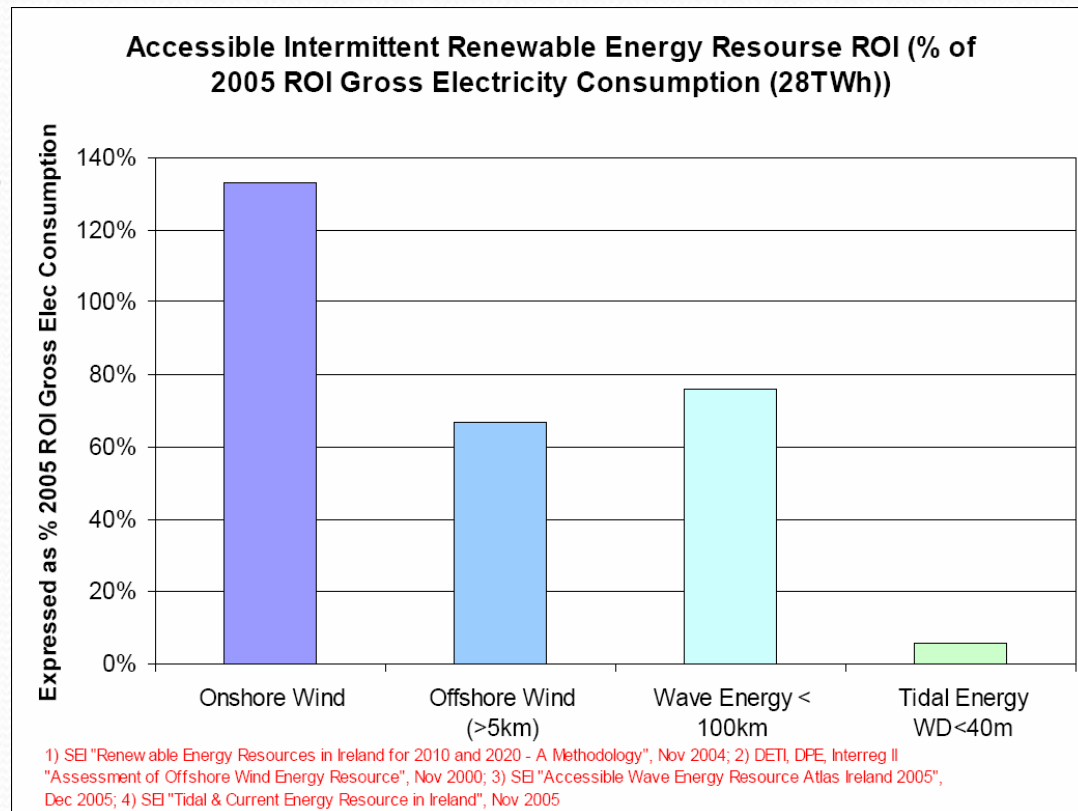
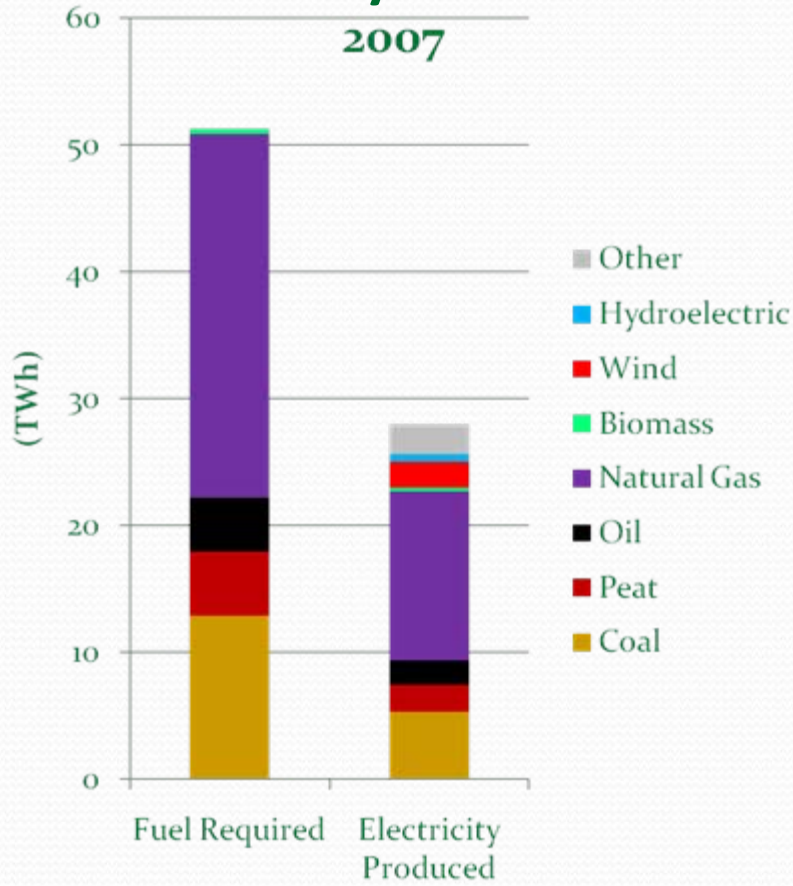
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10th June 2009

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Ireland's* Electricity Production and the Potential for Renewable-Generated Electricity**

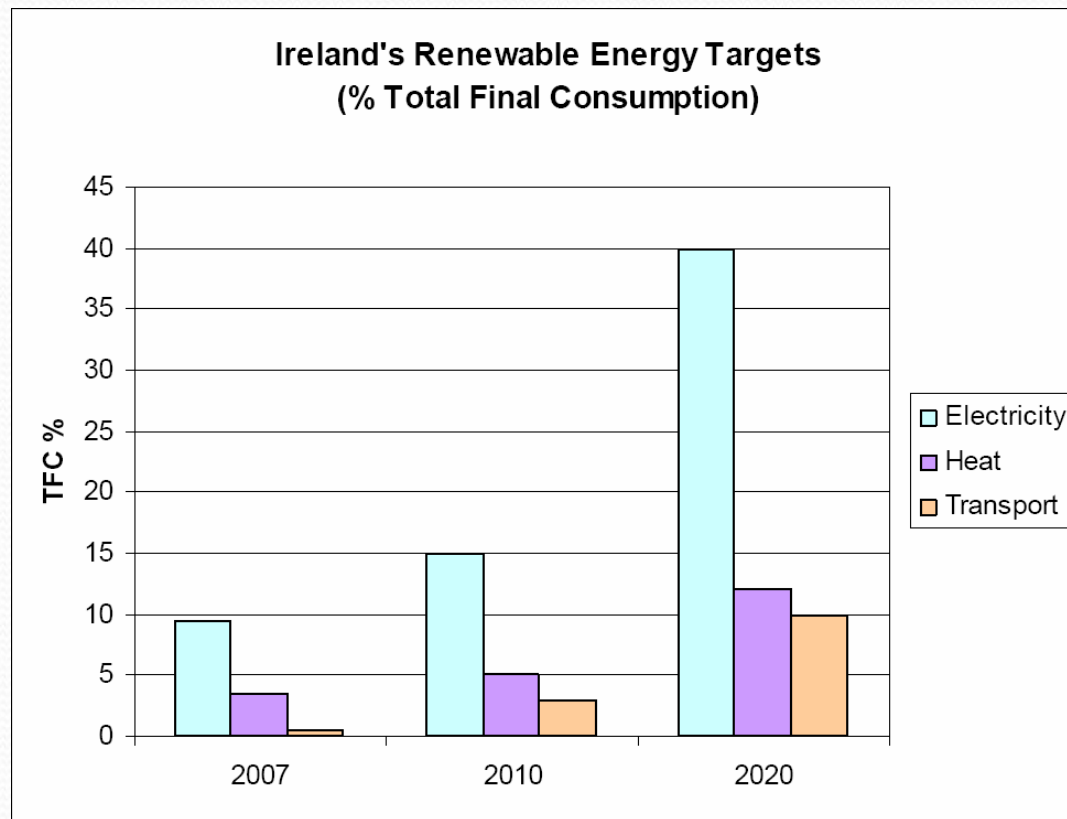


***Republic of Ireland Only**
David Connolly - University of Limerick

****Graham Brennan, Sustainable Energy Ireland**

10 June 2009

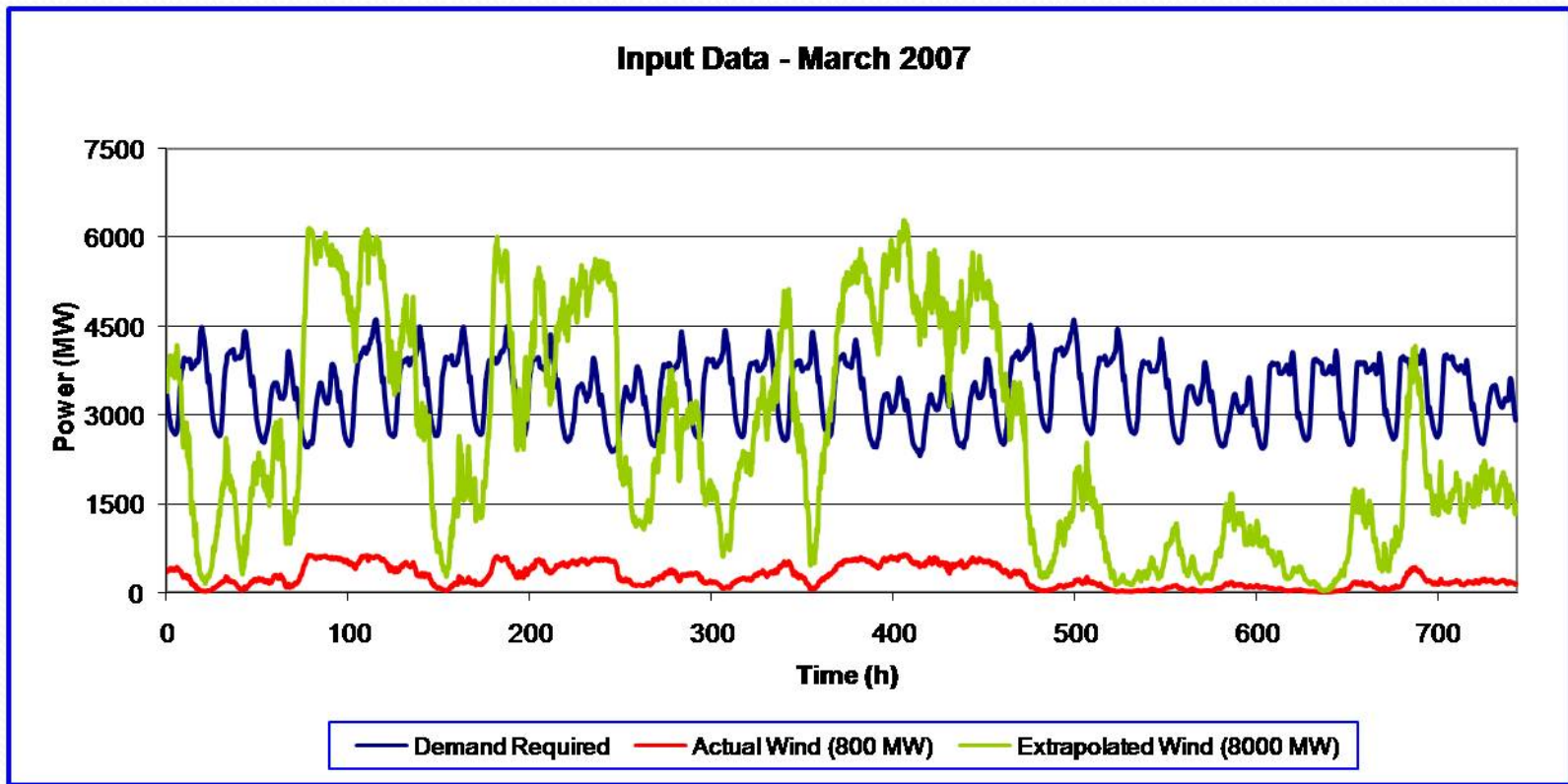
Ireland's Energy Targets*



*Graham Brennan, Sustainable Energy Ireland



What's the problem? - Intermittency



Objective

How do we integrate the most renewable energy into the Irish energy-system, with minimal negative

Utilise
More RE

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Review of Energy Models

- Carried out a broad initial review
- Created a shortlist of 6 models
- Obtained and tested these models



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- Obtained and tested these models
- EnergyPLAN was chosen



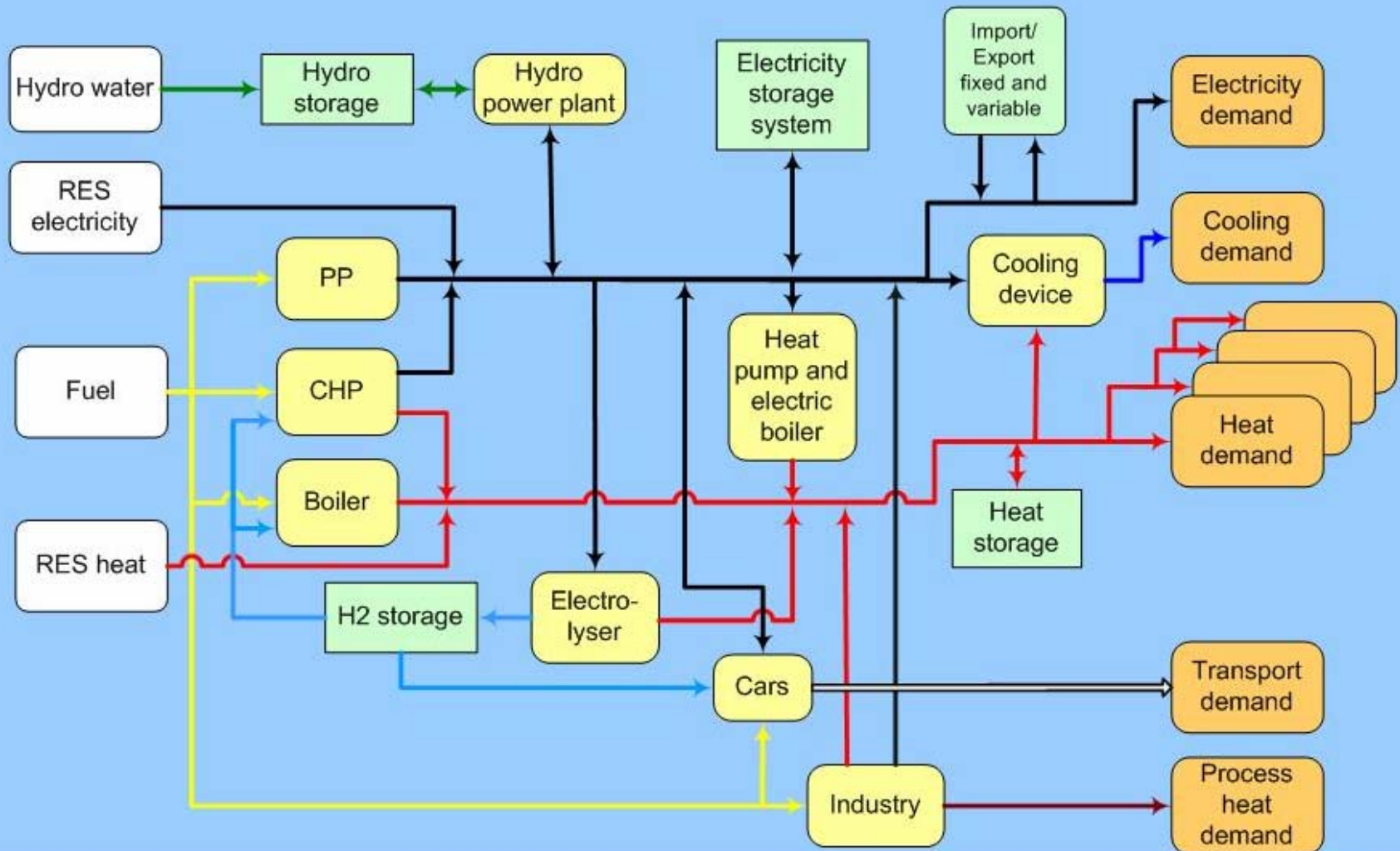
EnergyPLAN was chosen

- Reasons for choosing EnergyPLAN:
 1. Free to download
 2. Considered all sectors of the energy-system
 3. Work using EnergyPLAN was regularly published in academic papers
 4. Previous work completed was very applicable to the objective of this study
 - A. Lund H, Munster E. **Management of surplus electricity-production from a fluctuating renewable-energy source**. Applied Energy 2003;76(1-3):65-74.
 - B. Lund H, Kempton W. **Integration of renewable energy into the transport and electricity sectors through V2G**. Energy Policy 2008;36(9):3578-3587.
 - C. Lund H, Mathiesen BV. **Energy system analysis of 100% renewable energy systems--The case of Denmark in years 2030 and 2050**. Energy 2009;34(5):524-531.



EnergyPLAN Structure

EnergyPLAN Energy System Analysis Model Version 7.01 - 23 April 2007



Reference Model

- Create a reference model – 2007
- Only modelled the Republic of Ireland
- Data was gathered on:
 - Electricity generation & consumption
 - Heat generation & consumption
 - Transport demands
 - Renewable energy generation i.e. Wind & hydro
 - Energy storage i.e. Turlough Hill
 - Industrial demands

Reference Model: Results

- 'Actual' and 'EnergyPLAN' results were compared:
 - CO₂ Emissions
 - Electricity demands / production
 - Heat demands / production
 - Transport demands
 - Import/Export electricity
 - Industrial CHP production
- It was concluded that the model was simulating the Irish energy-system accurately

Reference Model: Results

- Electricity produced from different units

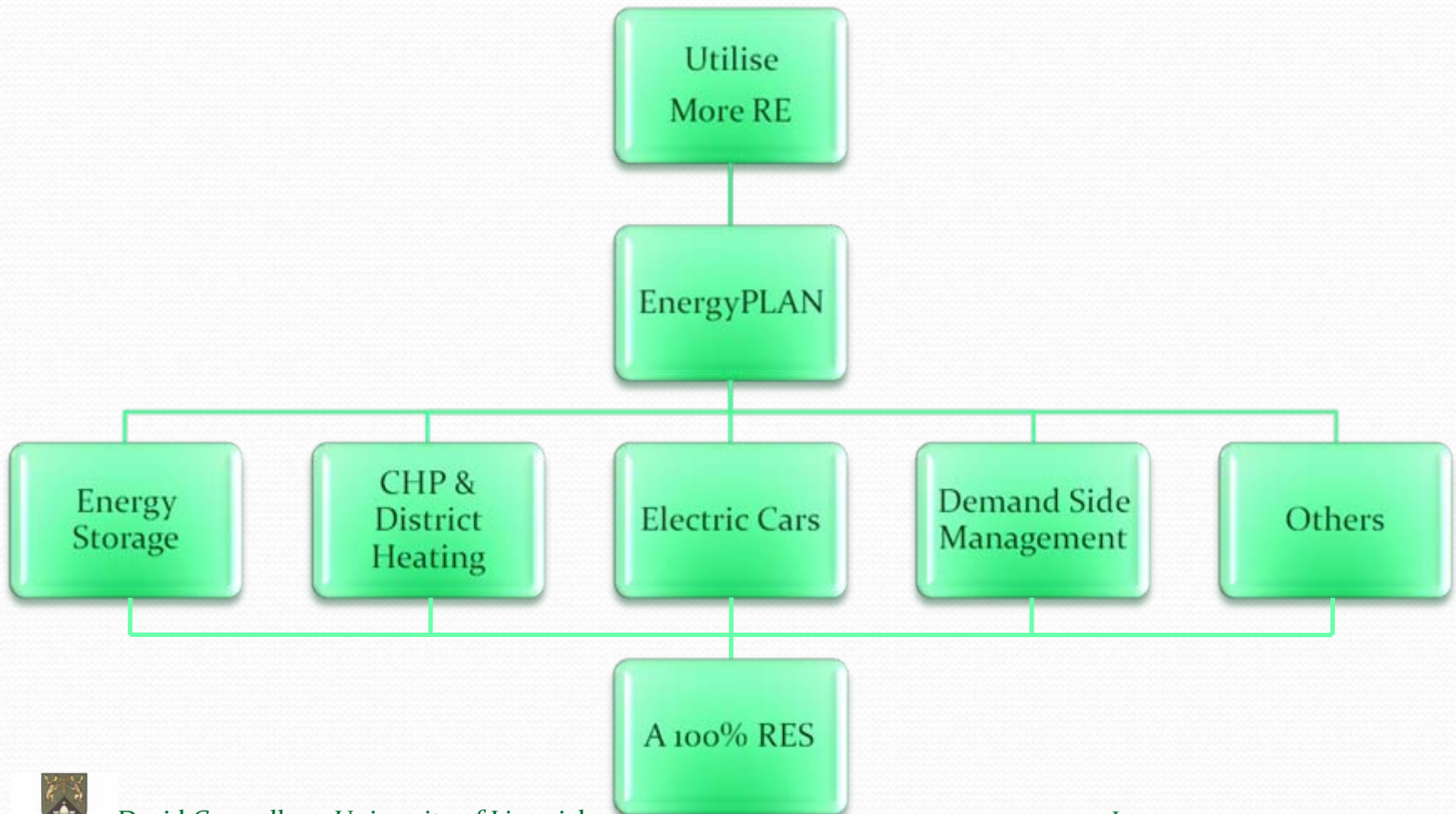
Production Unit	Actual Production in 2007 (TWh)	EnergyPLAN Production in 2007 (TWh)	Difference	
			TWh	%
Power Plants	23.56	23.54	0.02	0.08
Wind Power	1.96	2.04	0.08	4.08
Hydro Power	0.66	0.66	0	0
Industrial CHP	0.93	0.93	0	0

Reference Model: Results

- Total Fuel Consumption in the Energy System

Fuel	Actual Fuel Consumption in 2007 (TWh)	EnergyPLAN Fuel Consumption in 2007 (TWh)	Difference	
			TWh	%
Biomass	2.77	2.83	0.06	2.17
Coal/Peat	25.70	25.69	0.01	0.04
Natural Gas	49.92	50.29	0.37	0.74
Oil	105.22	104.42	0.80	0.76
Renewables	2.65	2.69	0.04	1.51

Future Objective: No CO₂?



Conclusions

- Developed a model of the Irish energy-system
- The model is simulating the Irish energy-system accurately
- Model will be used for future alternatives with specific focus on high renewable-penetrations

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