



Knowledge Exchange Seminar Series (KESS)

...is a forum that encourages debate on a wide range of research findings, with the overall aim of promoting evidence-based policy and law-making within Northern Ireland



Energy Storage in Northern Ireland for Efficient Network Use

Professor Philip Griffiths

Head, School of the Built
Environment

Professor Neil J Hewitt

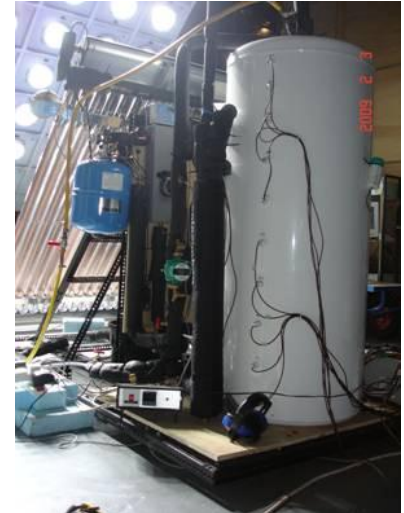
Director, Centre for Sustainable
Technologies

Centre for Sustainable Technologies

Building Energy Systems
Bio-energy
Demand Side Management
Energy Storage
Energy Process Modelling
Energy Market Modelling
Heat Pumps
Passive Buildings
Solar Energy
Thermal Comfort



Laboratories



Solar Research



Low Carbon Retrofit



Heat Pump Research

Energy Research Track Record ~£13M

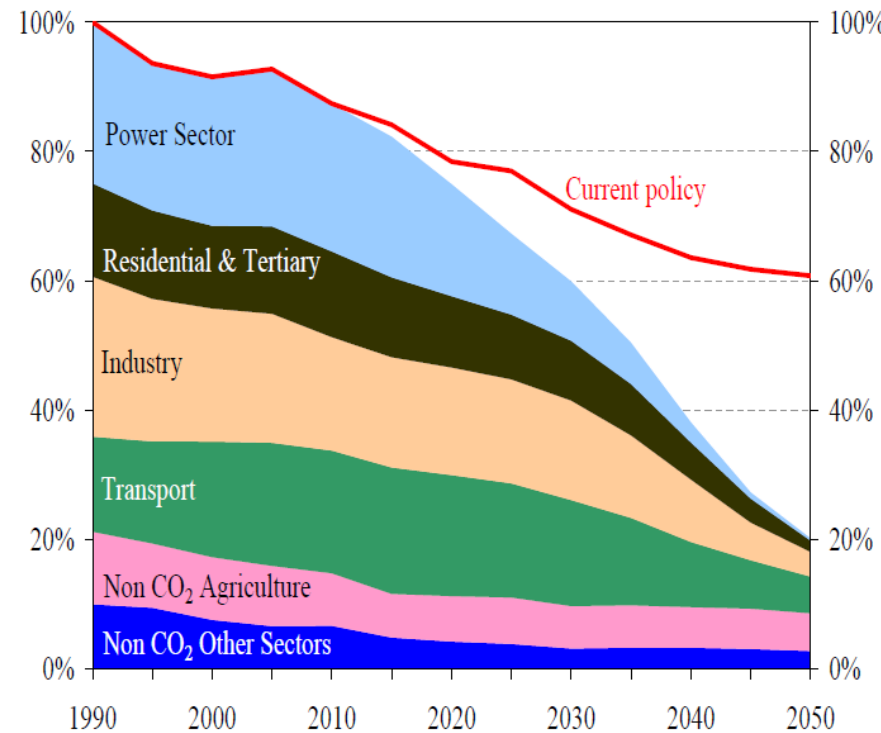
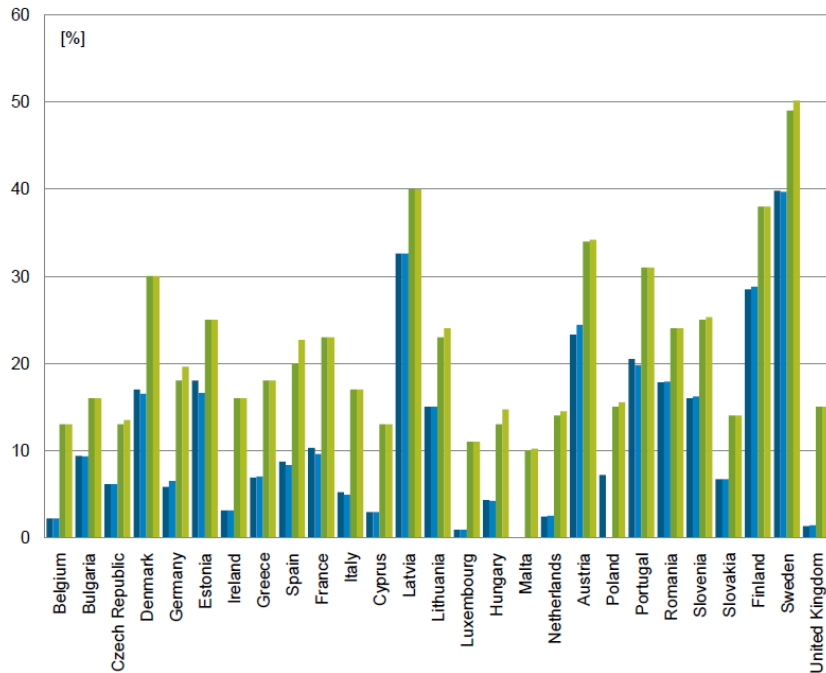
Grant	Awarding Body	Amount	Timeframe
Charles Parsons Energy Research Award	DCMNR	£2,400,000	2007-2015
Decarbit	EU FP7	£160,000	2007-2012
Biofuel Micro-Trigeneration with Cryogenic Energy Storage	EPSRC	£126,685	2008-2012
CALEBRE	EPSRC	£272,482	2008-2012
Variable Capacity Heat Pump Development	DEL CAST & Copeland Ltd	£70,000	2008-2011
Energy Storage	DEL	£1,600,000	2008-2011
Solar Energy Storage	INI Proof of Concept	£101,000	2008-2010
Photobioreactors	INI Proof of Concept	£104,000	2010-2011
Biomara	EU Interreg	£181,189	2009-2013
NPP OCTES	EU Interreg	£150,000	2011-2013
CESAR	FP7	€355,000	2011-2013
EINSTEIN	FP7	€500,000	2011-2015
MERITS	FP7	€250,000	2012-2016
Copper Industries	TSB INI	£107,000	2012-2014
Total Energy Management in Production Operations	Enterprise Ireland	€300,000	2012-2015
NPP SuLa	EU Interreg	£150,000	2012-2014
POREEN	EU Marie-Curie	£50,000	2012-2016
High Performance Vacuum Flat Plate Solar Collectors	EPSRC	£300,000	2013-2017
i-STUTE	EPSRC	£880,000	2013-2018
SPIRE	EU INTERREG	£2,933,000	2013-2015
Scarlet	FP7	£300,000	2014-2017
GRAGE	H2020	£80,000	2014-2018
Eco-City	ILEX/DCC	£48,000	2014-2015
INPATH-TES PhD on Innovation Pathways for TES	H2020	€192,000	2015-2018



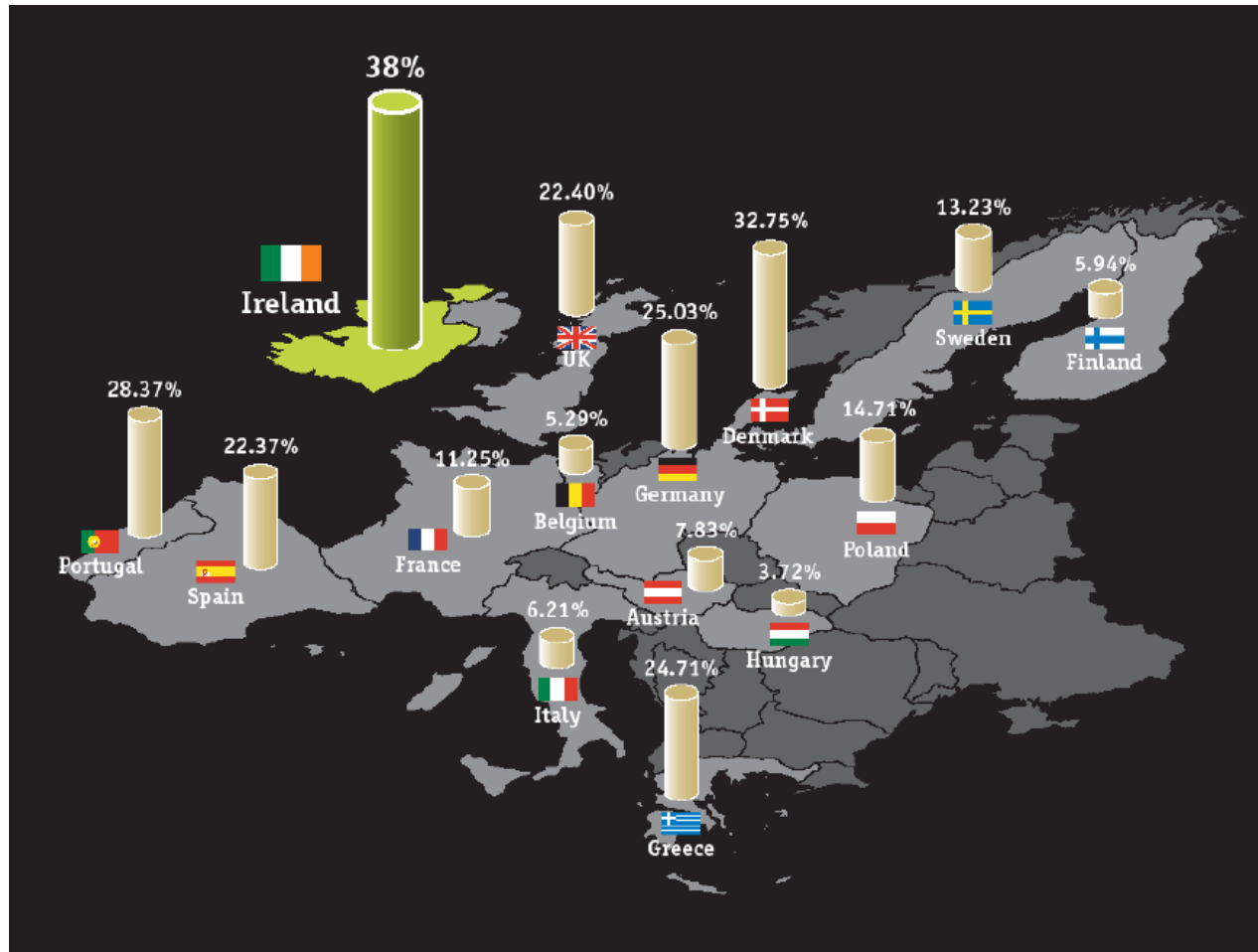


WHY ENERGY STORAGE?

Policy Drivers, 2020 to 2050

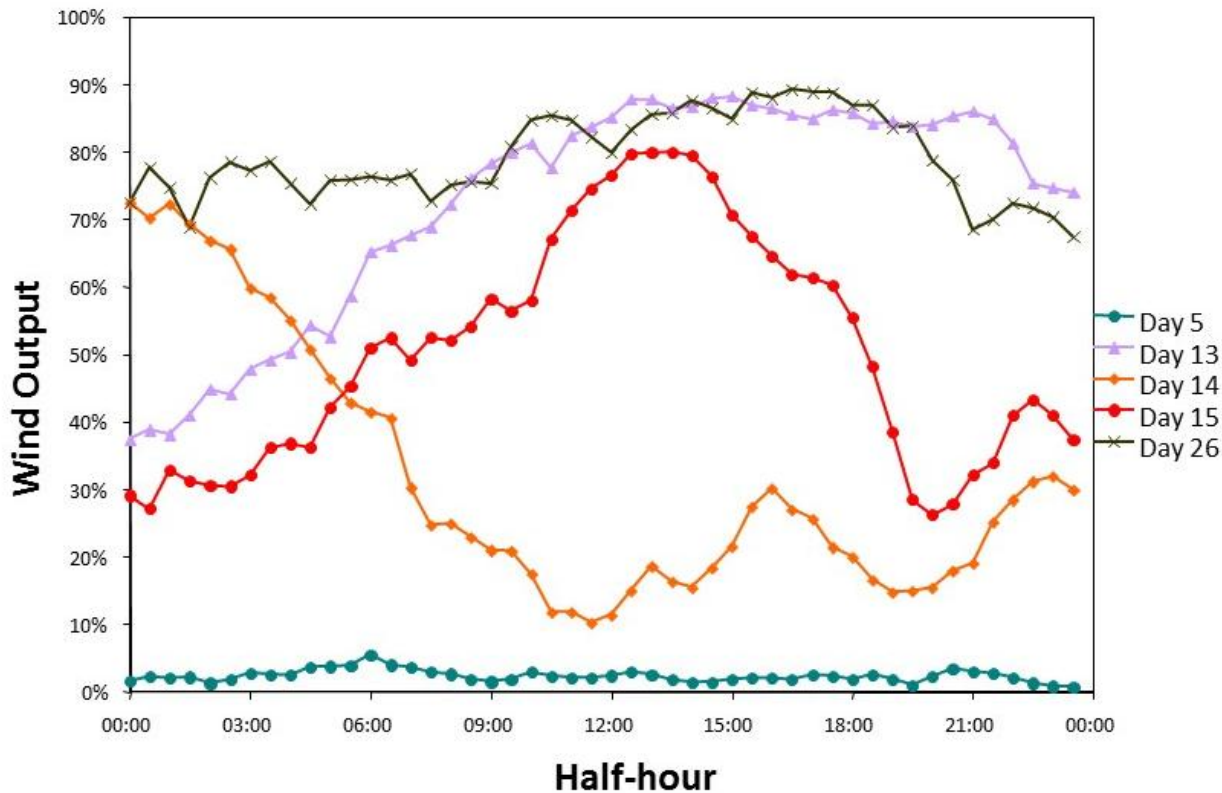


SEM, Wind & 2020

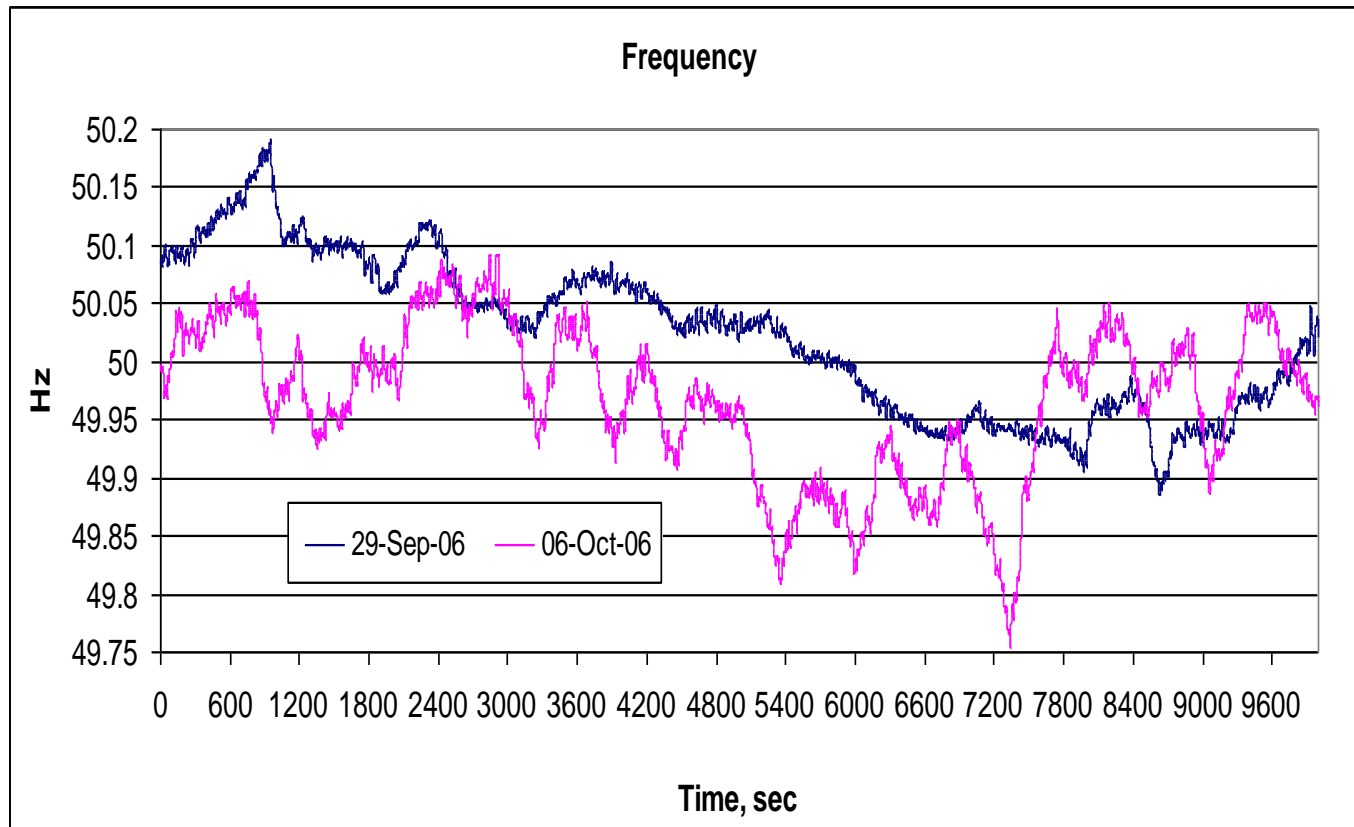


EIRGRID

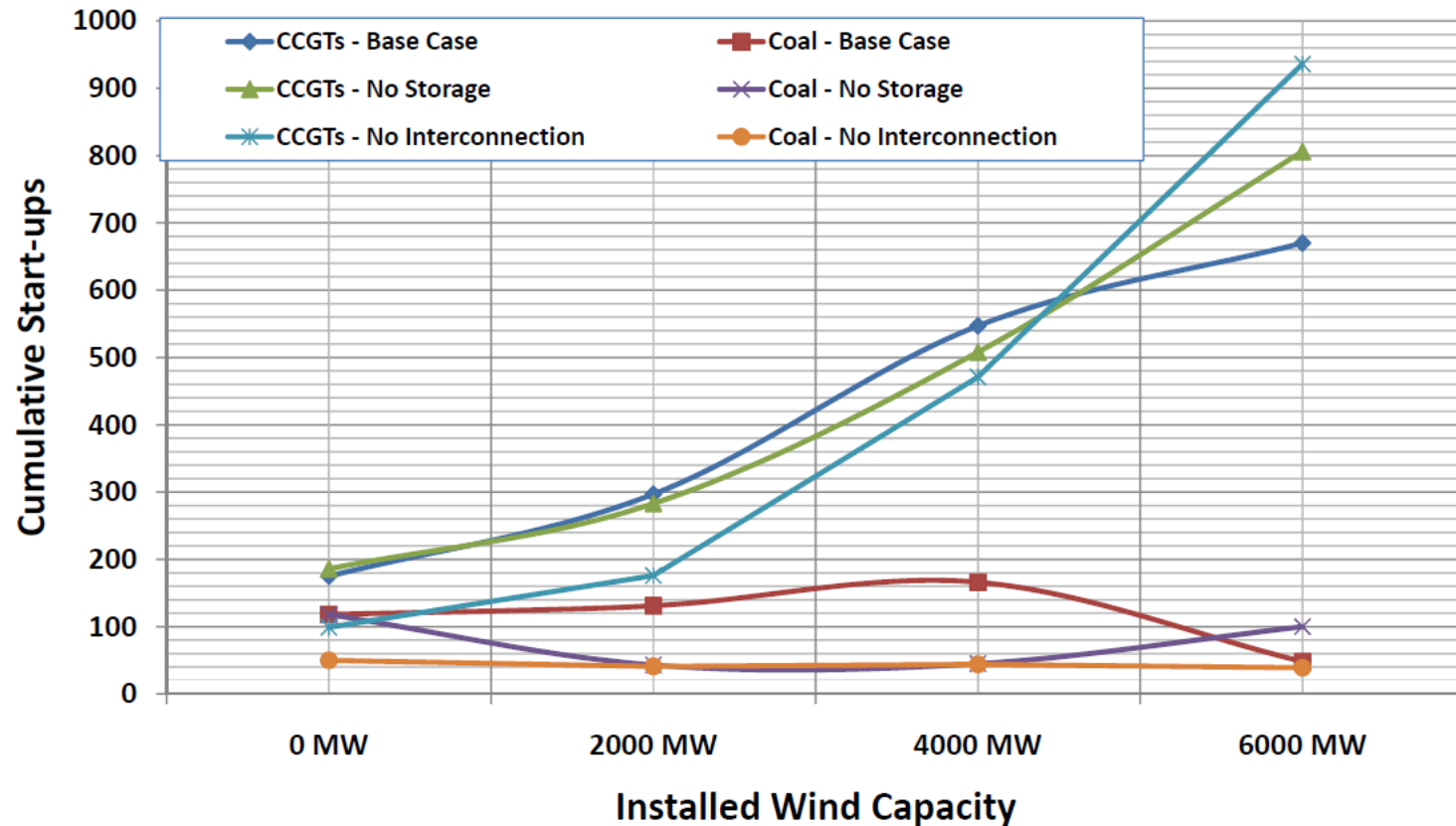
Impacts of Non-Synchronous Generation - Availability



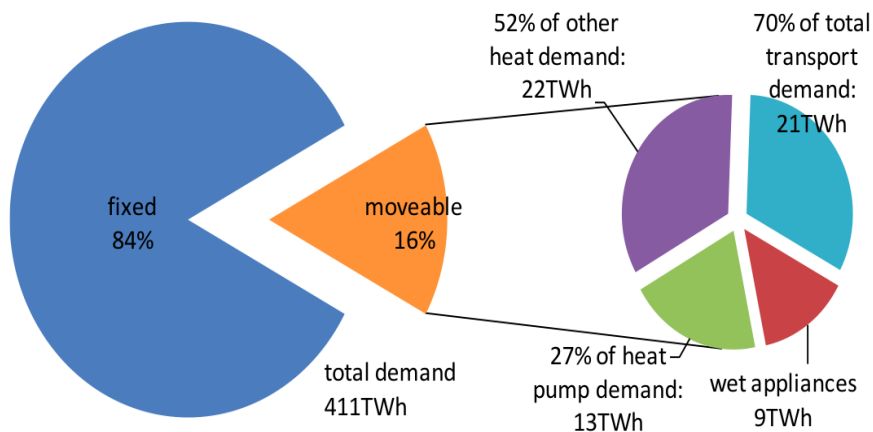
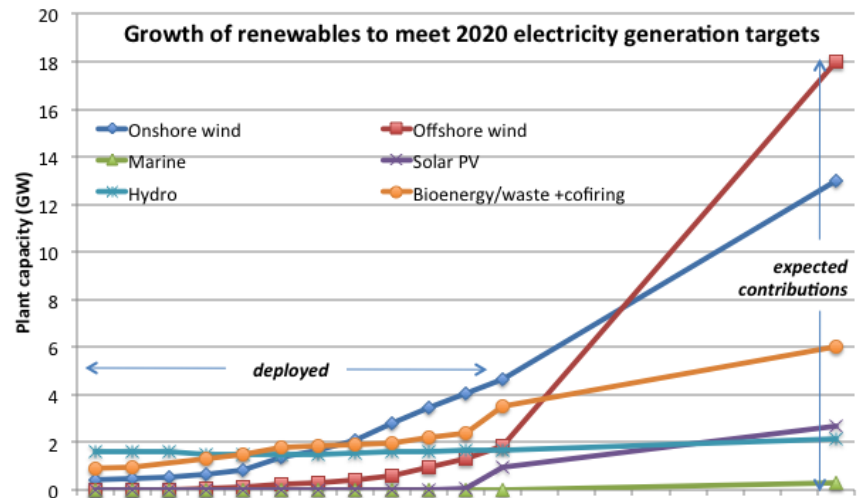
Impacts of Non-Synchronous Generation - Stability

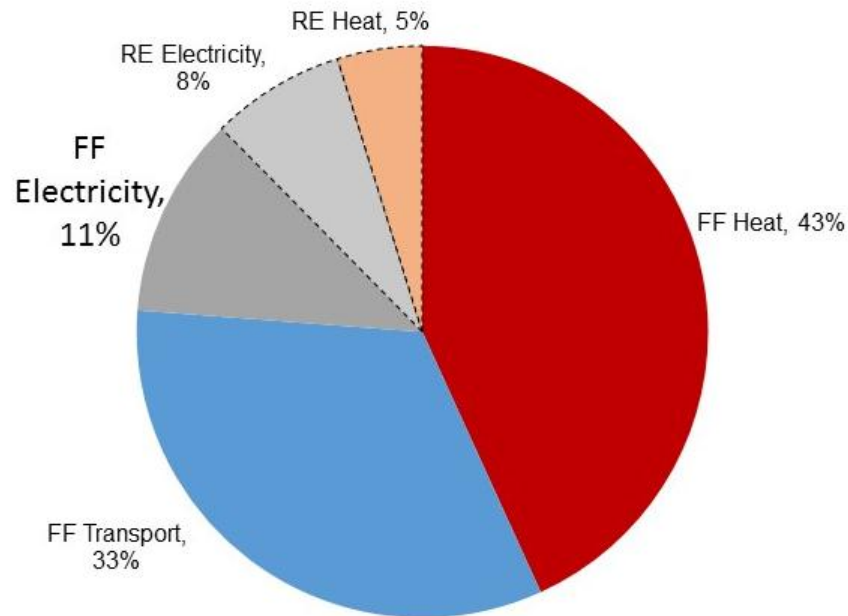


Impacts of Non-Synchronous Generation – Power Station Starts



And the UK view?

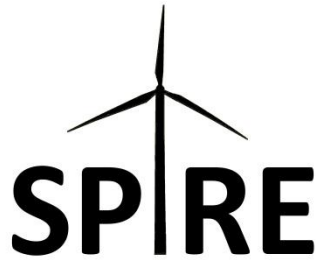




Source: DETI, Envisioning the Future - Considering Energy in Northern Ireland to 2050. Ricardo AEA Report, July 2013

WHAT TYPES OF ENERGY STORAGE

Ulster Projects of Energy Storage



European Union
European Regional
Development Fund
Investing in your future



**Northern Ireland
Executive**

www.northernireland.gov.uk



Ireland's EU Structural Funds
Programmes 2007 - 2013

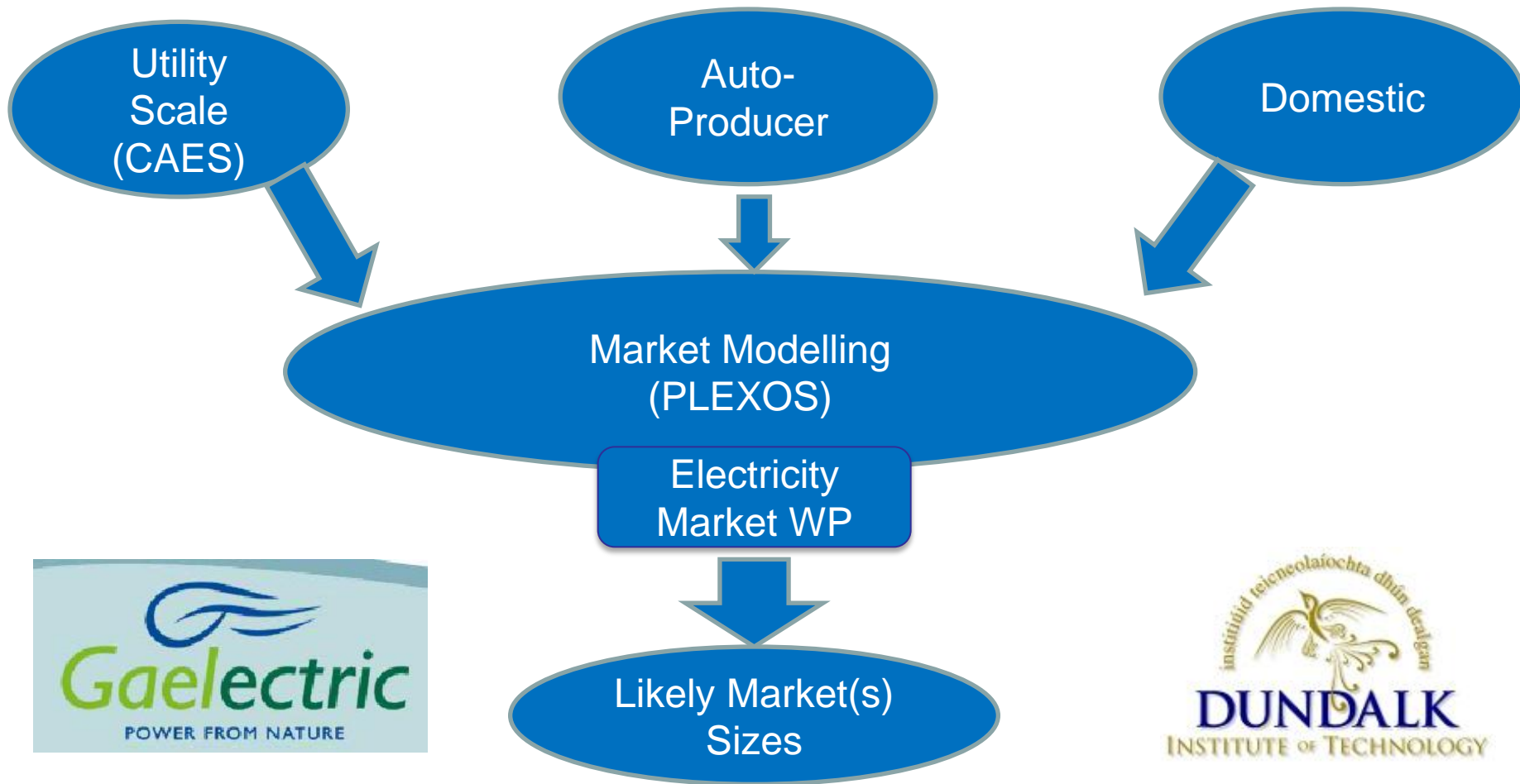
Co-funded by the Irish Government
and the European Union



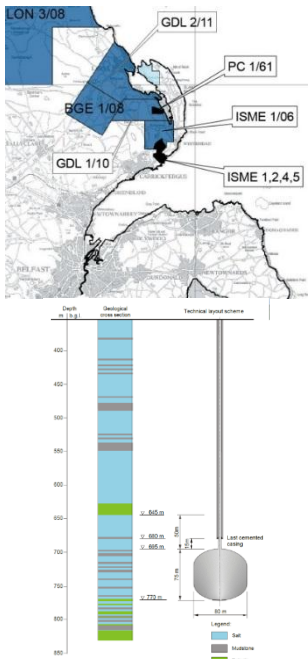
Special EU Programmes Body
Foras Um Chláir Speisialta An AE
Boord O Owre Ocht UE Projects



SPIRE



Compressed Air Energy Storage - CAES

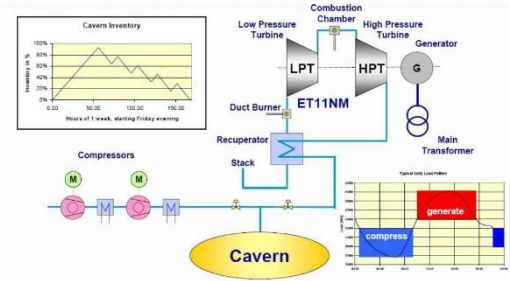


SPIRE

Autoproducer
Electricity & Heat



Demand Side Management Heat Pumps & Thermal Storage



SPIRE – Example Results

Parameter	Units	No Flexible Generation	Storage 100MW	Storage 200MW	Storage 300 MW	Storage 400 MW	BaU	Advanced CCGT
Average spot price	€/MWh	83.83	83.14	82.72	82.87	82.26	83.62	82.62
Total Energy Market System costs	€ , m	3,528	3,499	3,484	3,477	3,454	3,523	3,470
Total system cost savings	(€, m) %	-	-29 (-0.82%)	-45 (-1.26%)	-51 (-1.44%)	-74 (-2.11%)	-5 (-0.15%)	-59 (-1.66 %)

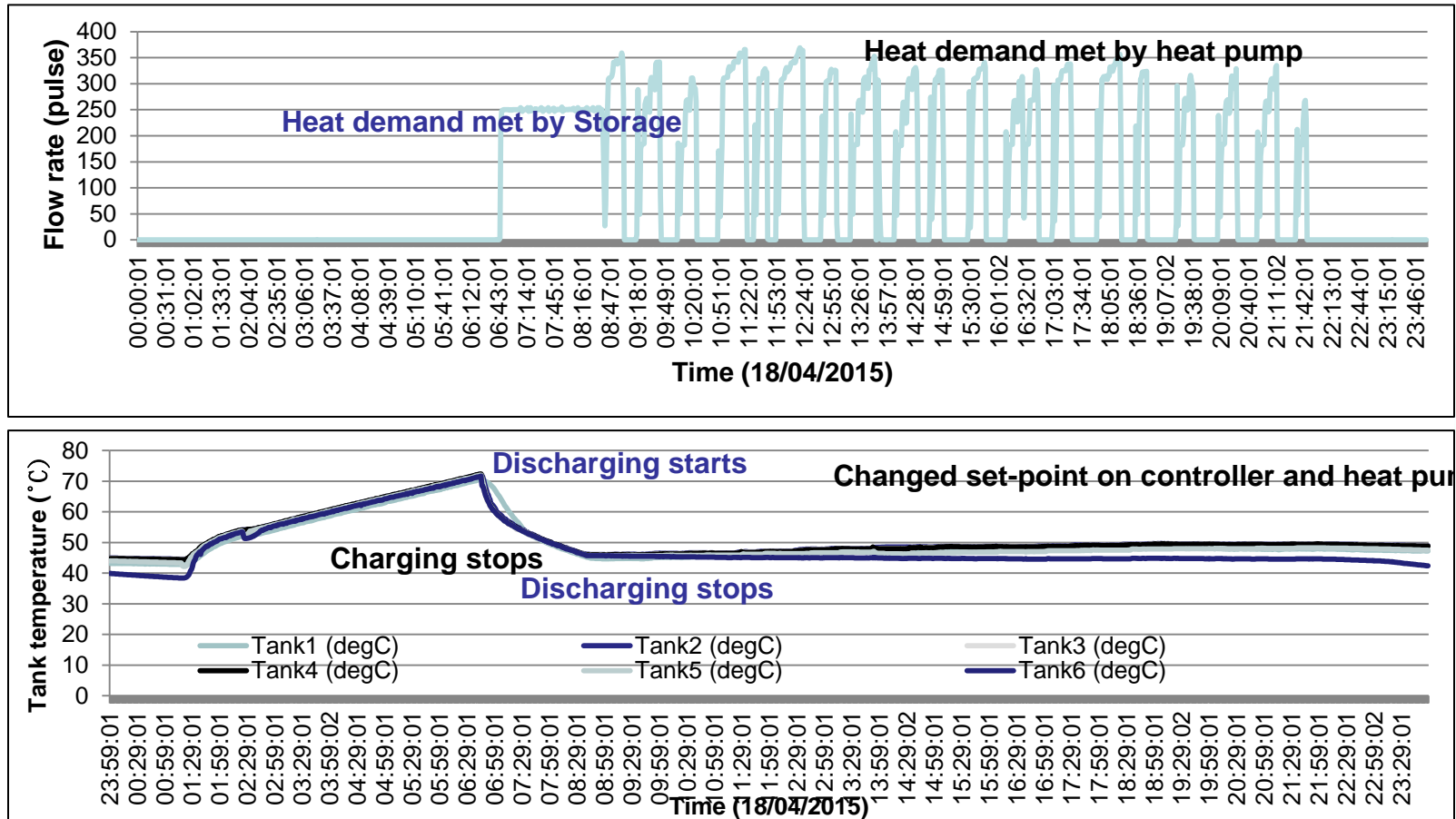
Effective Integration of Seasonal Thermal Energy Storage Systems in Existing Buildings



800 cu.m & 150 sq.m solar array & 90 kW Thermal Heat Pump

Evaporator		Condenser		POWER	Heat Cap.	COP
m	ΔT	m	ΔT	Win	Qcond	
kg/s	K	kg/s	K	kW	kW	kW/kW
0.8	9.26	1.26	7.16	6.93	37.75	5.45
0.96	8.18	1.26	7.52	7.12	39.58	5.56

Interdisciplinary centre for Storage, Transformation and Upgrading of Thermal Energy



And to Conclude

Ulster has significant expertise in

Modelling energy storage systems

Developing relevant technologies

Understanding their benefits to the Single Electricity Market

THANK YOU





Northern Ireland
Assembly



Queen's University
Belfast



The Open
University



Ulster
University

Knowledge Exchange Seminar Series (KESS)

...is a forum that encourages debate on a wide range of research findings, with the overall aim of promoting evidence-based policy and law-making within Northern Ireland