Planning Considerations for Emerging Renewable Energy Technologies

EU SPECIAL PILOT TRAINING
23rd July, 2015

John McCann, SEAI

- EU Renewable Energy Policies and Targets
- Current and Emerging Renewable Technologies
- Planning Considerations for Renewable Energy Technologies
- Key Technology Examples
- The Ultimate Emerging Technology

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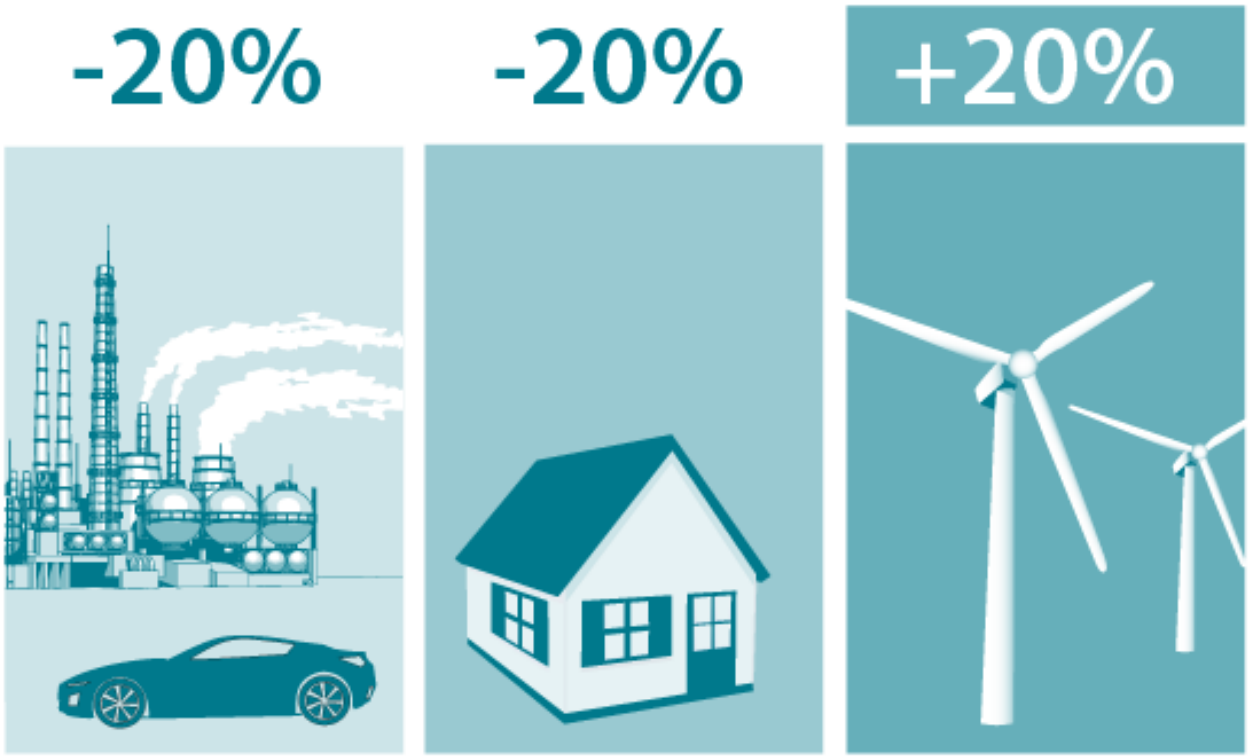
The 20-20-20 EU Policy

By 2020:

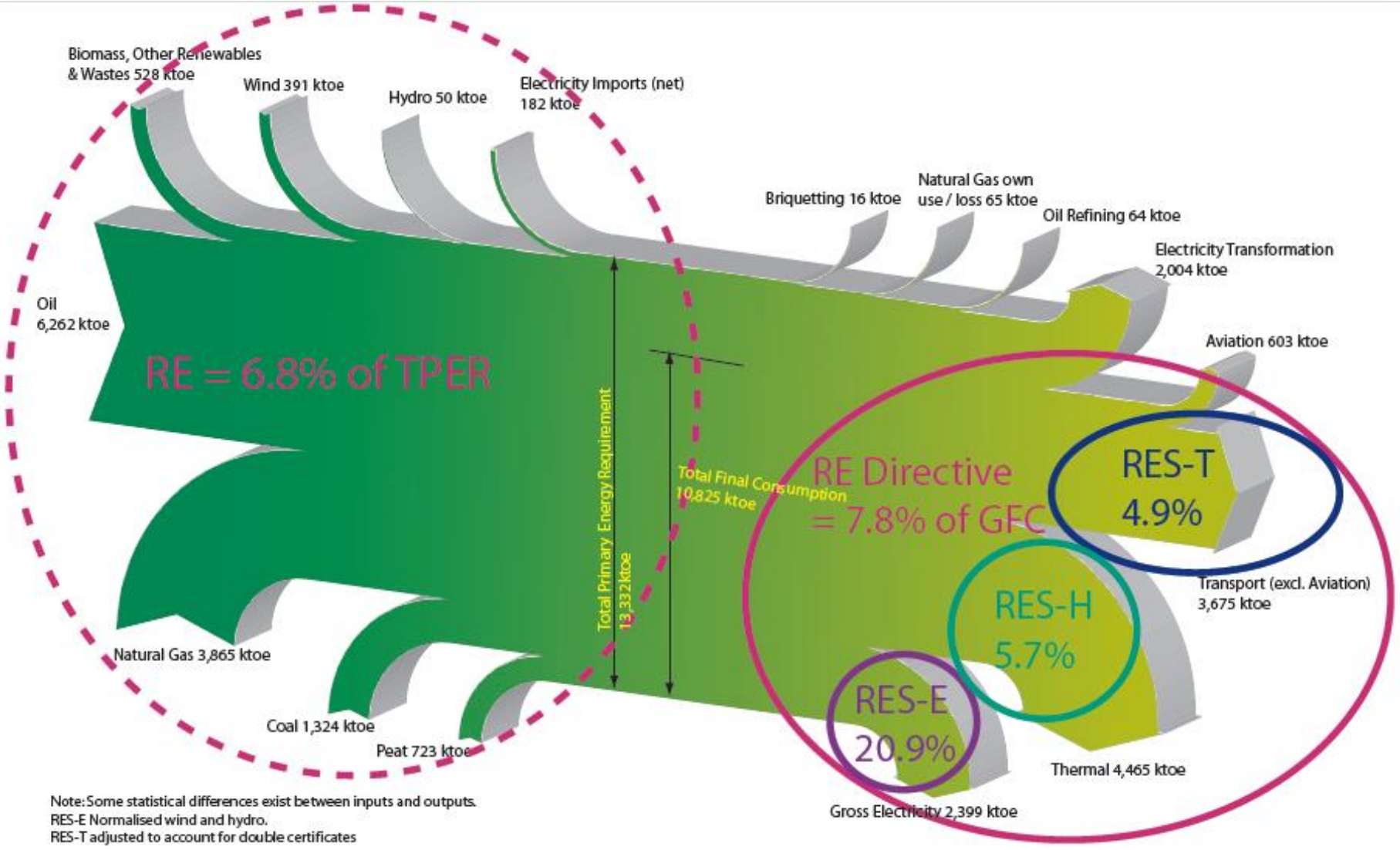


By 2030: **- 40%** **- 27%** **27%**

EU Renewable Energy Targets

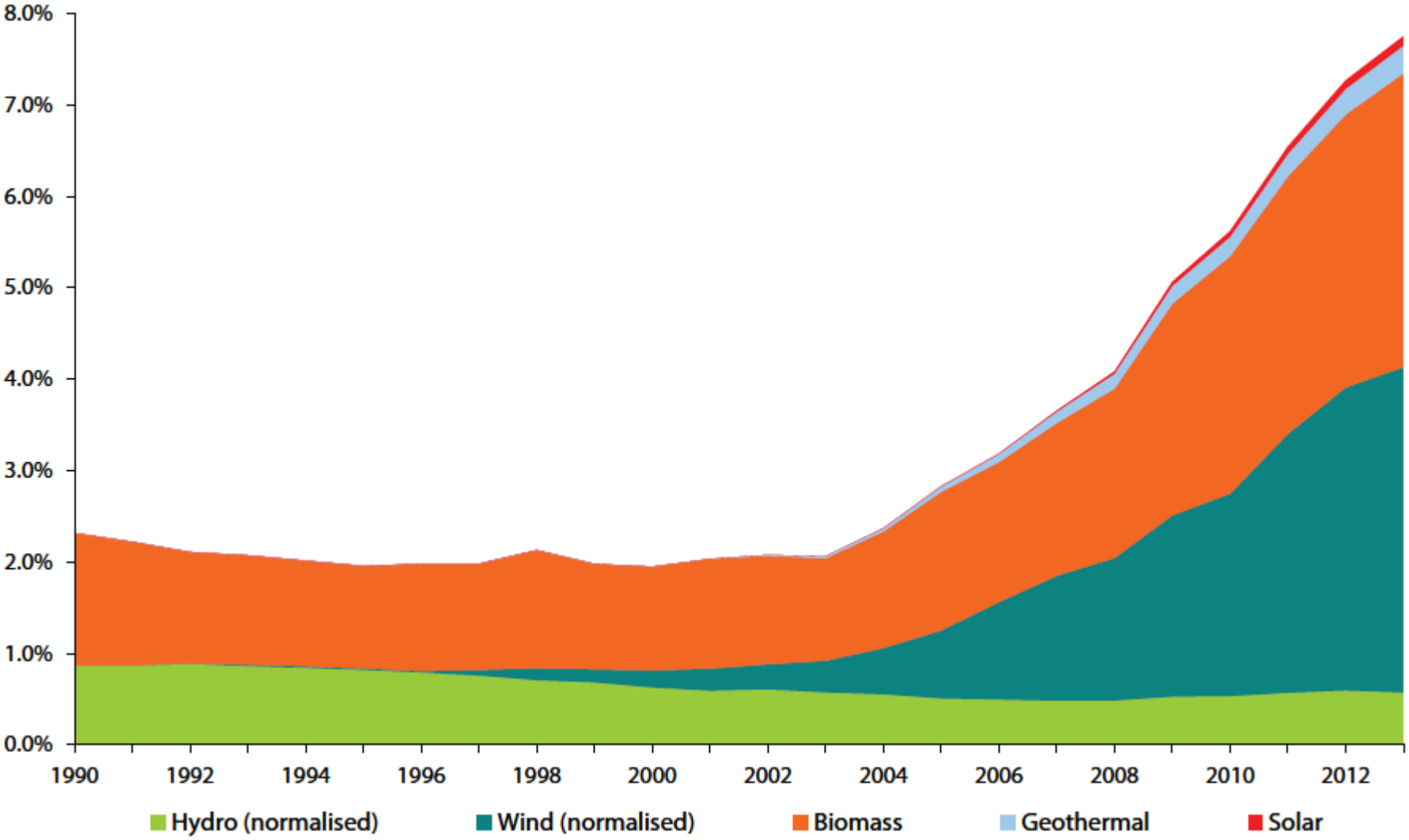
- **EU Directive 2009/28/EC**
- Mandatory Targets for Ireland
- **16%** RES - Energy by 2020
    - also 10% RES-Transport by 2020
- Indicative Sectoral Targets
    - **Transport 10%; Electricity 40%; Heat 12%**
- **EU 2030 Framework for Climate and Energy**
- EU Wide 27% Share of Renewable Energy, No Individual National Targets for Renewable Energy

2020 Targets Progress
End of 2013



Note: Some statistical differences exist between inputs and outputs.
RES-E Normalised wind and hydro.
RES-T adjusted to account for double certificates

Renewable Energy Contribution to Gross Final Consumption



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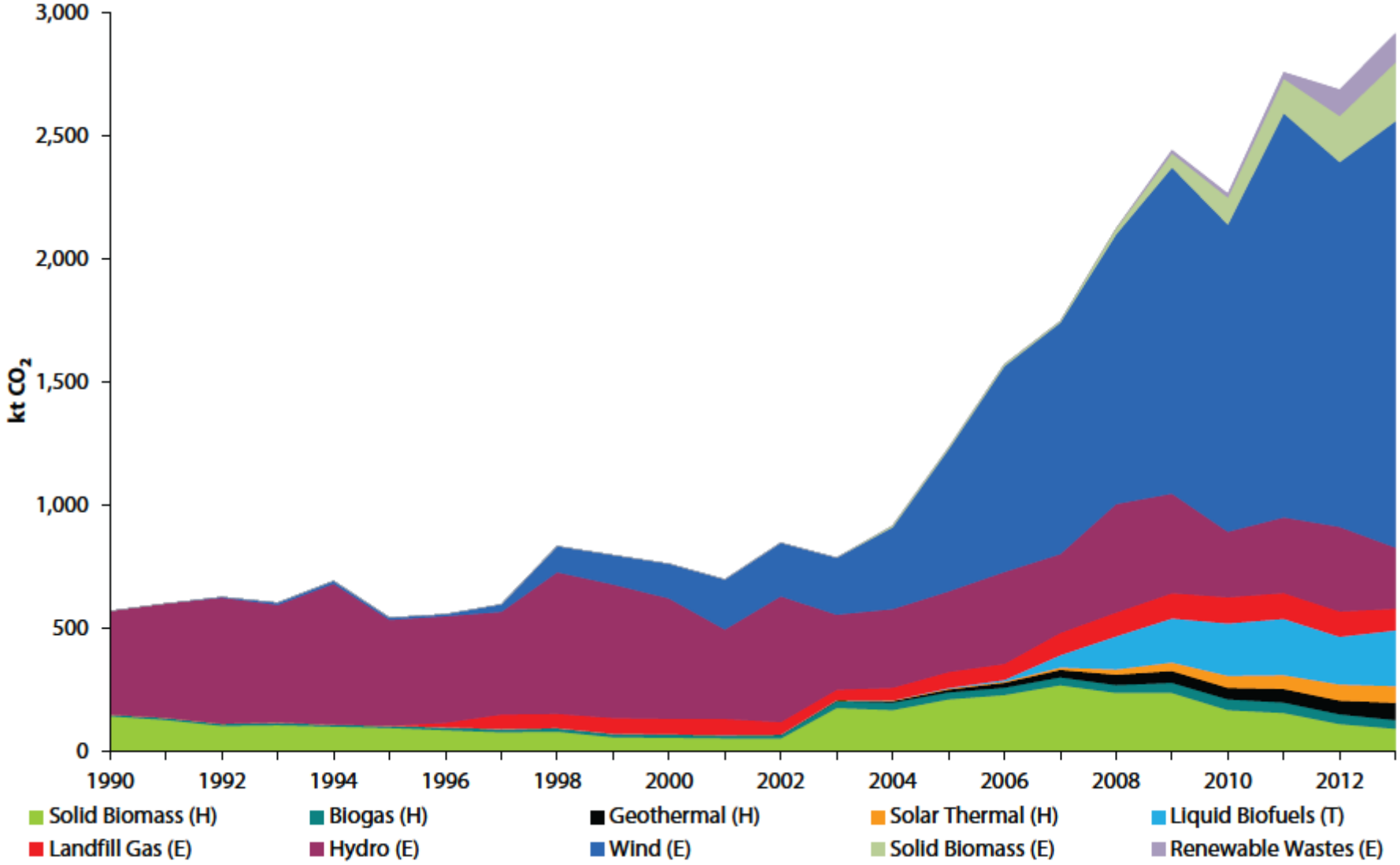
Avoided CO_2 Emissions from Renewable Energy



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Current and Future Technologies

Current Renewable Energy Technologies:

- Hydropower – Large scale, small scale, micro-hydro
- Wind Energy – Onshore, Offshore
- Solar Energy – Solar Thermal, Solar PV, CSP
- Geothermal Energy – Heat and Electricity
- Bio-Energy – Biomass, Biogas, Biofuels
- Heat Pumps – Air- , Ground- & Water- Source

Emerging Technologies:

- Ocean Energy – Tidal Energy, Wave Energy
- Biofuels- Cellulosic Bio-Ethanol, Algae Fuels
- Geothermal – Hot Dry Rock
- Solar – Concentrated Solar PV, Artificial Photosynthesis
- Wind – Floating Offshore, Kite Power

IEA RETD Emerging Technology Matrix

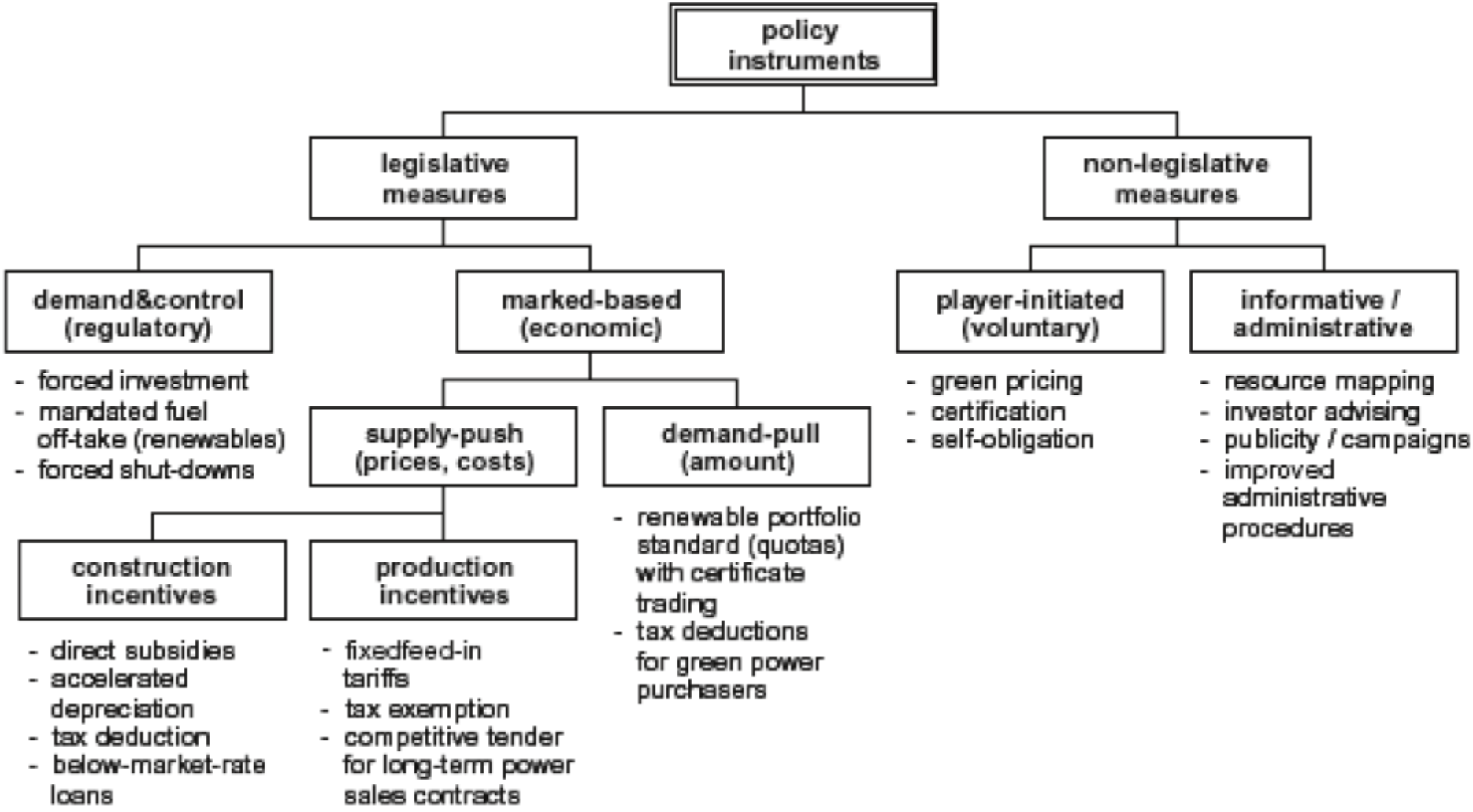
	Research & Development "Concept"	Demonstration "Emerging"	Early Deployment "Emerging"	(Near) Commercial "Advanced"
Hydropower		• Hydrokinetic turbines		• Run-of-river • Reservoirs • Pumped storage
Bioenergy	• Aquatic plant-derived fuels	• Pyrolysis biofuels • Gasification based biofuels or biomethane • Fermentation of lignocellulosic material	• Gasification-based power • Lignocellulosic syngas-based biofuels	• Combustion for power and/or heat • Anaerobic digestion • Sugar & starch ethanol • Plant & seed oil biodiesel
Wind	• Wind kites • Higher-altitude wind generator		• Offshore, large turbine	• Onshore • Turbines for water pumping
Solar	• Solar fuels	• Solar cooling	• Solar cooking • Concentrating PV • CSP	• PV • Low temp solar thermal • Passive solar architecture
Geothermal	• Submarine geothermal	• Engineered geothermal systems		• Geothermal heat pumps • Hydrothermal binary cycle/condensing flash
Marine	• Currents/thermal conversion • Salinity gradients	• Wave	• Tidal currents	• Tidal range

Source: IEA RETD

Technology Development Phases and Government Supports

Source: IEA RETD

Energy Policy Mechanisms



Source: N. Enzensberger et al. Energy Policy 30 (2002)

Ireland: Current Policy Framework

	Policy Category	Capital Grants				Prod Incentive	Tax Incentive	Regulation
Sector	Technology	R&D	Demonstration	Deployment	Producer Grant	Feed in Tariff		
Electricity	Large Wind (> 5MW)	Y				Y	Y	
	Small Wind (<=5MW)	Y				Y	Y	
	Offshore Wind	Y					Y	
	Hydropower	Y				Y	Y	
	Wave Energy	Y	Y	Y			Y	
	Tidal Energy	Y	Y	Y			Y	
	Solar PV Large Scale	Y					Y	
	Solar PV Commercial Building	Y					Y	Y
	Solar PV Microgeneration	Y					Y	Y
	Geothermal Electricity	Y					Y	
	Biomass Landfill Gas	Y				Y	Y	
	Biomass Combustion	Y			Y	Y	Y	
	Biomass Combustion - Energy Crops	Y			Y	Y	Y	
	Large Biomass CHP (> 1500kW)	Y			Y	Y	Y	
	Small Biomass CHP (<=1500kW)	Y			Y	Y	Y	
	Large AD Non CHP (> 500kW)	Y				Y	Y	
	Small AD Non CHP (<= 500kW)	Y				Y	Y	
	Large AD CHP (> 500kW)	Y				Y	Y	
	Small AD CHP (<= 500kW)	Y				Y	Y	
Heat	Biomass Boiler Wood Chip	Y			Y	!	Y	Y
	Biomass Boiler Pellet	Y			Y	!	Y	Y
	Biomass Boiler Energy Crops	Y			Y	!	Y	Y
	Solar Thermal - Commercial	Y					Y	Y
	Solar Thermal - Domestic	Y		Y			Y	Y
	Heat Pump - Air Source	Y					Y	Y
	Heat Pump - Ground Source	Y					Y	Y
	Heat Pump - Water Source	Y					Y	Y
Transport	BioEthanol	Y					Y	Y
	BioDiesel	Y					Y	Y
	BioGas	Y					Y	
	Electric Vehicles	Y		Y			Y	

Associated Technologies and Infrastructure

Energy Storage:

- Pumped Storage
- Flywheels
- Battery Storage
- Heat Storage

Infrastructure:

- Transport – Biomass Harvesting Distribution & Import
- Heat Distribution Networks
- Electricity and Gas Networks for Renewable Energy
- Electric Vehicle Recharging Stations
- ICT Infrastructure, Smart Grids, Smart Cities

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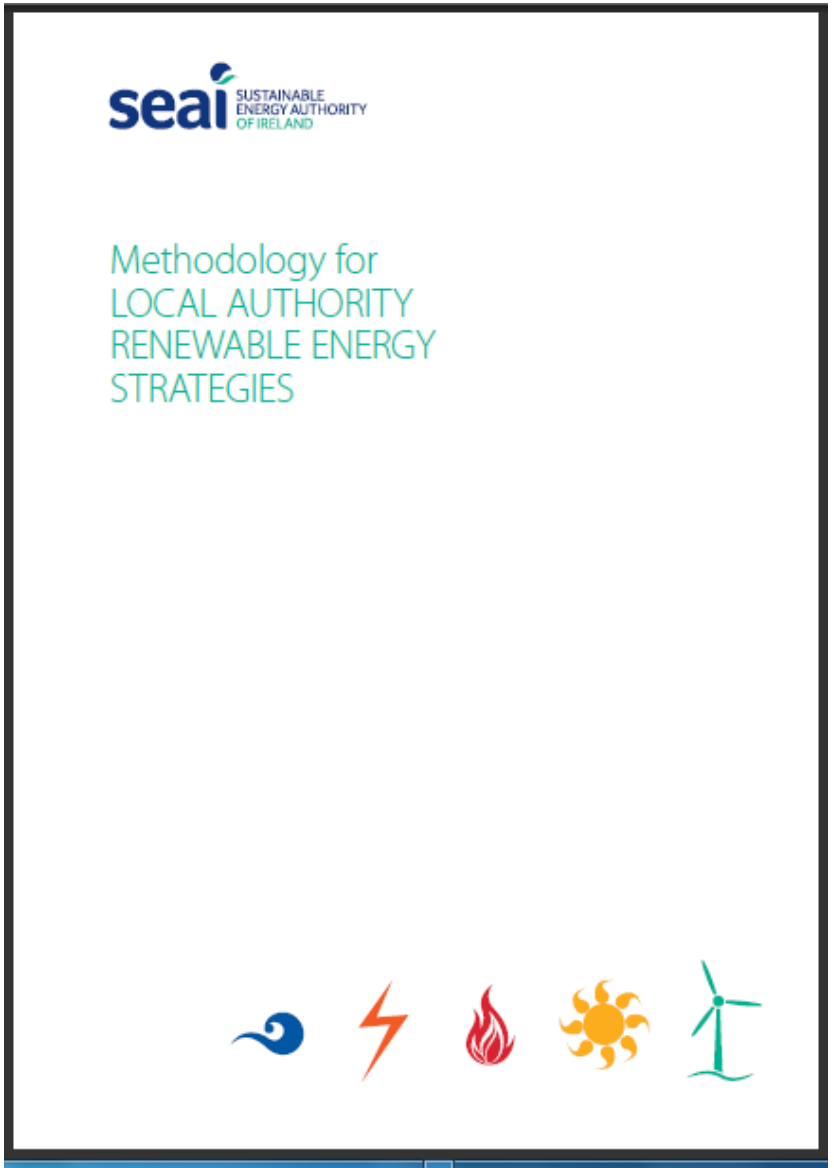
Planning Consideration of Novel RE Technologies

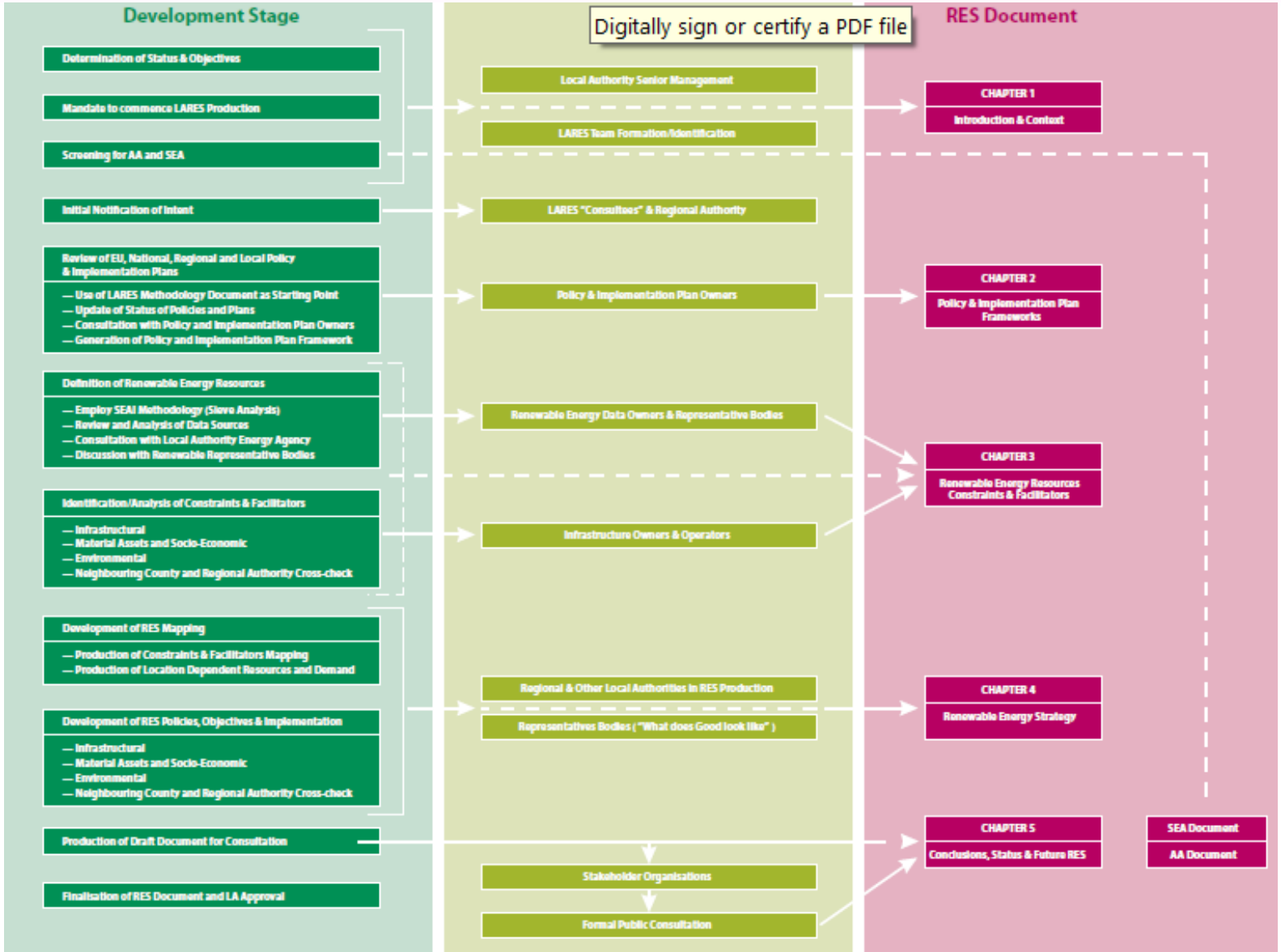
- Forward & Strategic Planning
  - LARES
  - CDP
  - SDZ
  - LAP
  - SEAP
- Development Consenting Process
  - National Guidance for Further Technologies
  - Further Planning Exemptions
  - Aesthetics, Local Planning Guidance

SEAI LARES
High Level Objectives

- Align County Development Plans with National Targets
- Facilitate Consistent Approach to RE by Local Authorities
- Ensure Alignment with Regional Development Plans
- Ensure All Available Resources are Considered
- Provide Appropriate Signals to RE Project Developers
- Facilitate Planning and Development of Electricity Infrastructure for Renewable Energy Projects



LARES Development Process



Key Renewable Energy Land Use Interactions

- Location & Land-Use
- Landscape and Visual Impact
- Site Conditions and Operation
- Infrastructure

Location & Land Use

Renewable Energy Source	Key Issues
Onshore Wind	Proximity to dwellings/businesses, habitats, other windfarms, other sensitive sites, etc.
Offshore Wind	Foreshore licence
Bioenergy	Proximity to raw material, dwellings, market, road network
Hydropower	Land take; impact on fish stocks
Solar	Specify for commercial or large-scale scheme at planning
Ocean Energy	Foreshore lease and onshore planning permission
Geothermal	Proximity to aquifers/water courses

Landscape & Visual Impact

Renewable Energy Source	Key Issues
Onshore Wind	Positioning, synchronicity of blades, visibility of access, visibility of cables and transformers
Offshore Wind	Height and number of turbines, distance from shore, position in relation to the horizon
Bioenergy	Impact depends on location – can be integrated into an industrial setting with little impact
Hydropower	Design of facility important to reduce impact on scenery
Solar	Protected structures or architectural conservation areas
Ocean Energy	Case-by-case
Geothermal	Large scale: stations for generation/distribution of electricity

Site Conditions & Operation

Renewable Energy Source	Key Issues
Onshore Wind	Landslide risk, shadow flicker, EM interference, ground water, ground conditions/geology
Offshore Wind	Potential disturbance during construction, coastal erosion, flooding
Bioenergy	Feedstock, pollution, contamination
Hydropower	Downstream effect, flood risk, construction effect on water course
Solar	N/A
Ocean Energy	Construction impacts from piling, dredging, etc.
Geothermal	Mostly in relation to deep, i.e. drilling etc.

Infrastructure

Renewable Energy Source	Key Issues
Onshore Wind	Grid connection; access for construction and accessibility for HGVs and cranes
Offshore Wind	Grid connections; access for construction and accessibility for HGVs and cranes
Bioenergy	Proximity to the National Grid / gas network; distribution of heat; traffic considerations for delivery of feedstock
Hydropower	Grid connection; access for construction and maintenance
Solar	Positioning of transformers and power cables where electricity is to be exported to the grid
Ocean Energy	Transport of components to onshore and elements
Geothermal	Access for construction and maintenance

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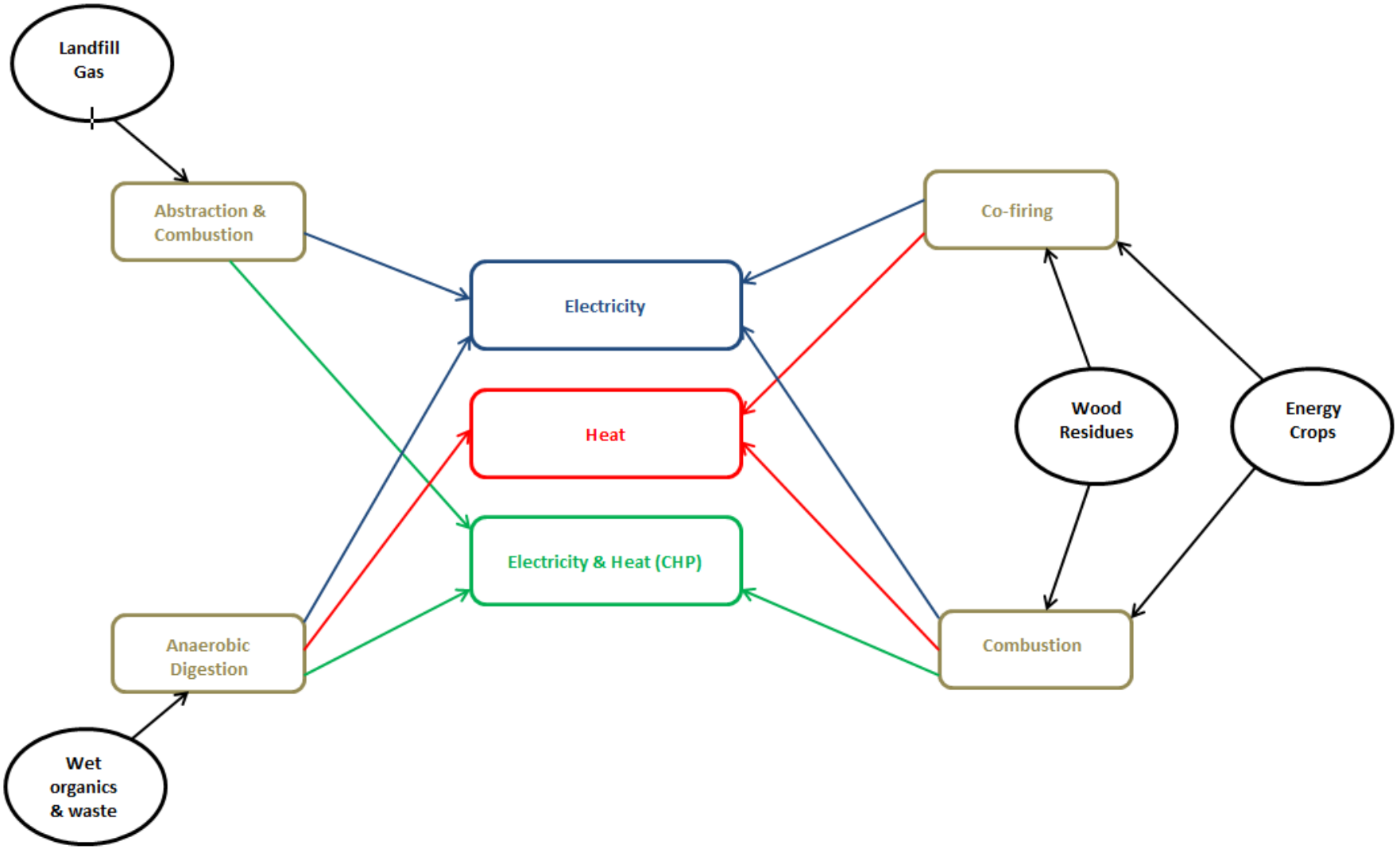
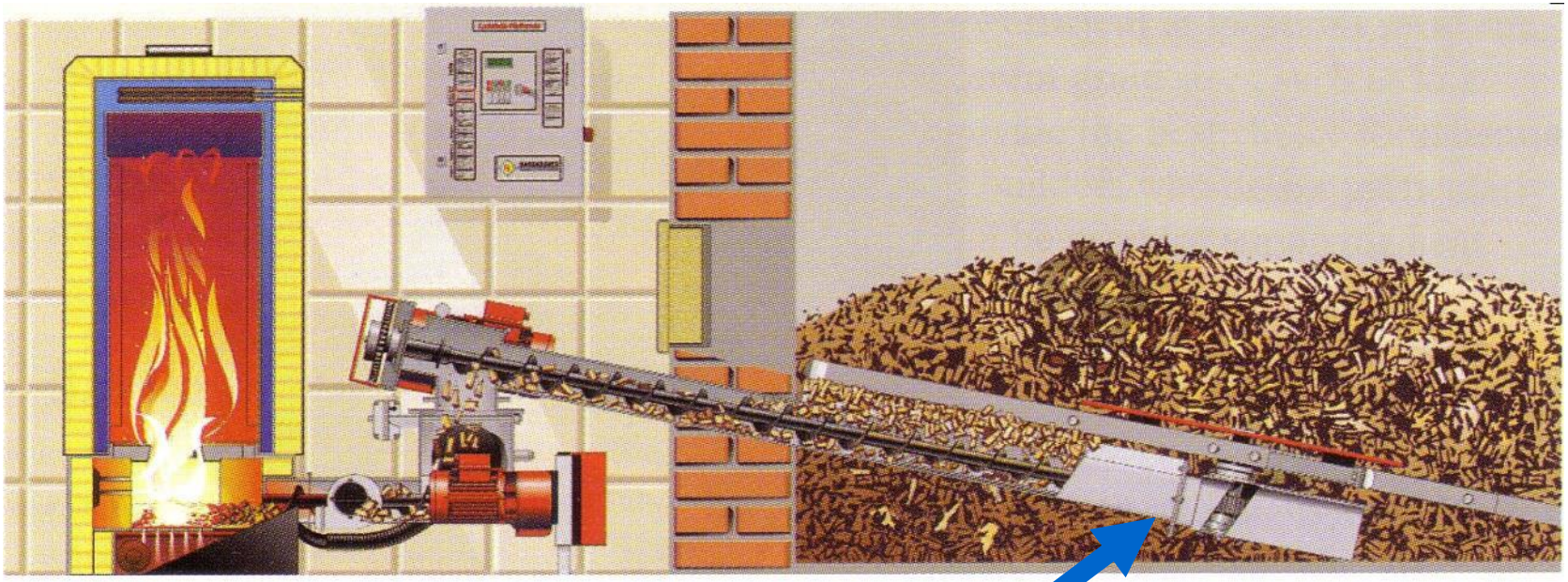
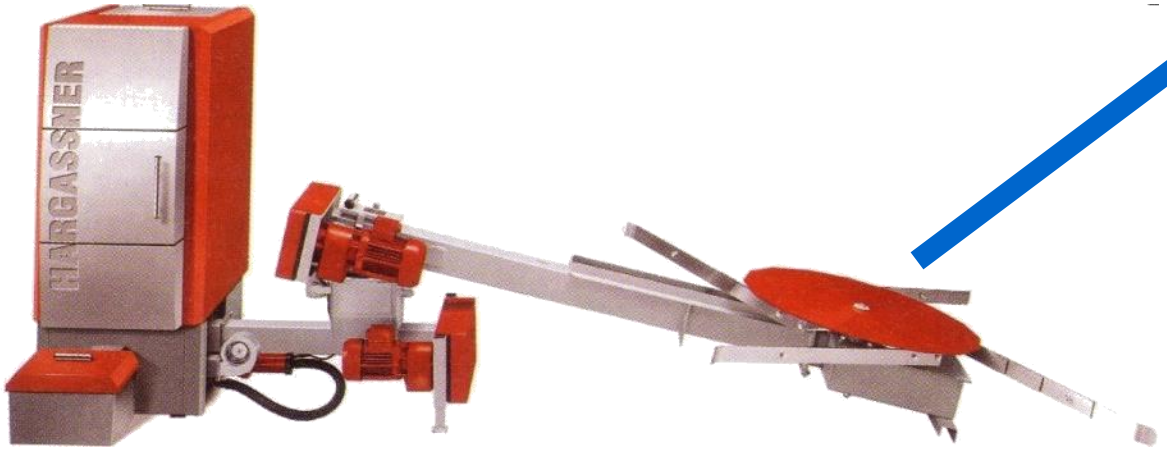
Conversion Technology: Biomass



Biomass Conversion Technology
Wood-Chip Boiler

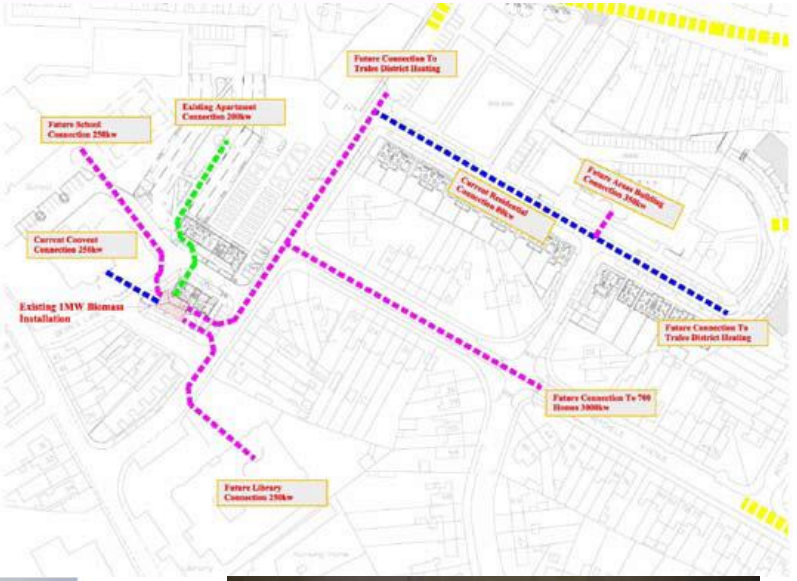




Biomass: Constraints & Facilitators

Location & Land Use	Landscape & Visual Impact	Site Conditions & Operation	Infrastructure
Proximity to raw material supply	Combustion facilities typically have large stacks	Feedstock: • Scale of facility • Recycling levels (WtE) • Non-haz wastes • Sorting of residuals	Electricity: proximity to grid connection is important
Proximity of bioenergy facility to dwellings and other sensitive locations such as schools and hospitals	Different facility will different stack/chimney requirements	Pollution: • Emissions • Noise (ops/traffic) • Odour • Light pollution • Contaminants to soil or groundwater	Heat: distribution network for users (or onsite use)
Proximity to end users, especially for heat-producing facilities	The siting of the facility will determine the impact, e.g. on-farm AD sites or landfill gas facilities	Other considerations: • Seepage from storage • Removal of cooling water/agents from gas cleaning • Hazardous end products	Traffic considerations for round-the-clock operations of large scale facility: • Proximity to transport network • Accessibility for feedstock delivery / residue removal • Road capacity • Road maintenance • Freight / rail?
Industries using their own residual resources do not need a well-developed transport network			

Biomass District Heating: Tralee



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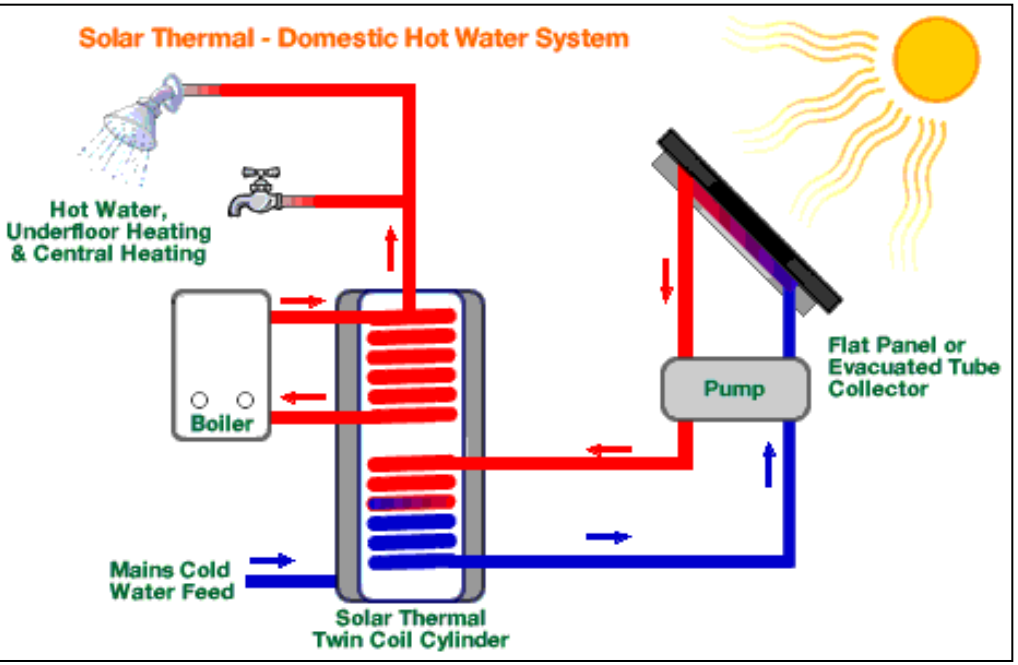
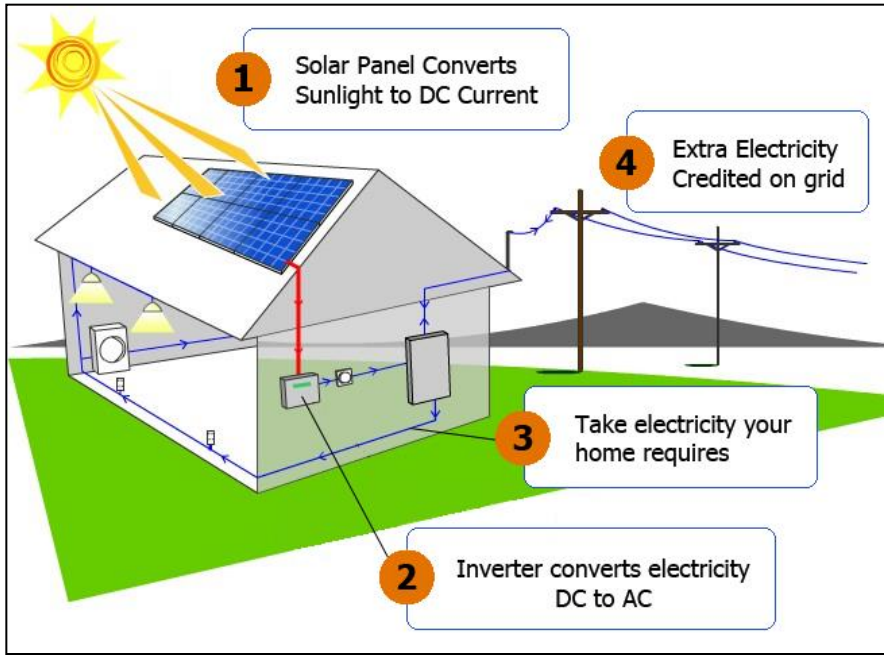
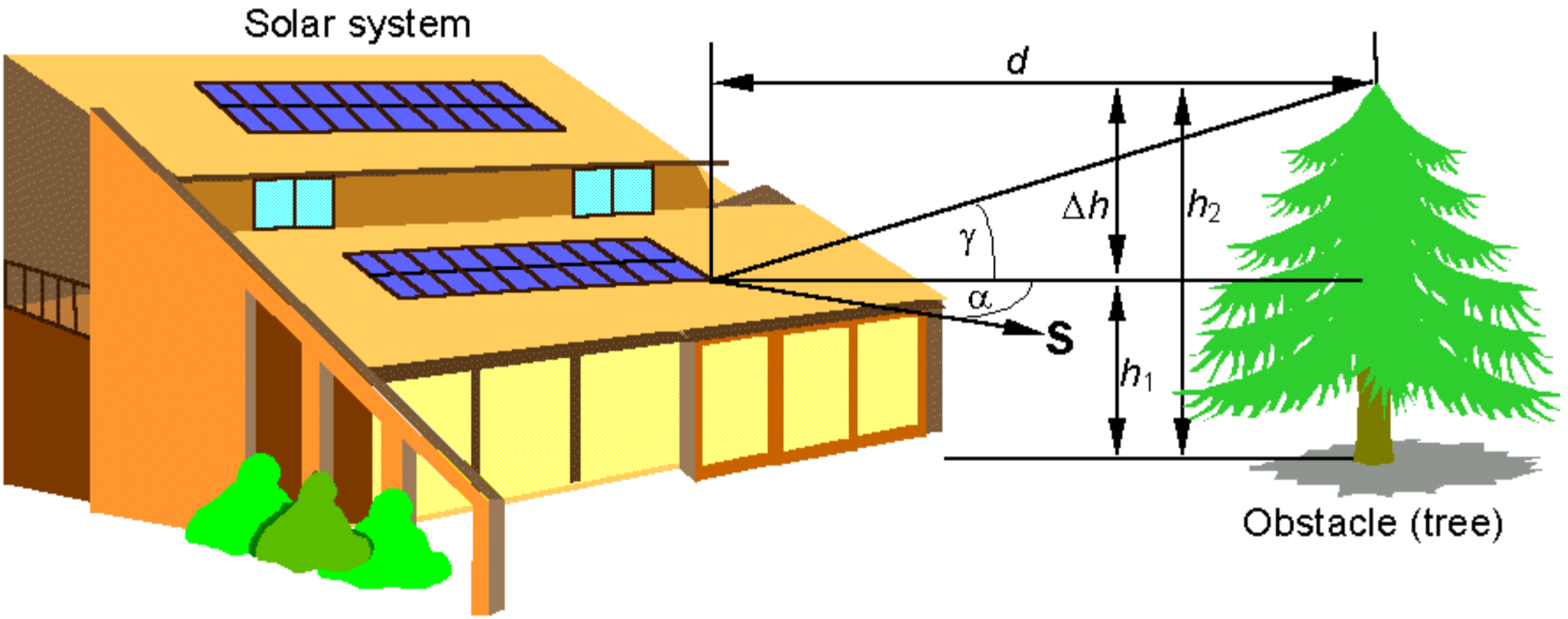
Biomass District Heating
A case study - The Mitchels Boherbee Regeneration Project

Conversion Technology: Solar





Effect of Shading



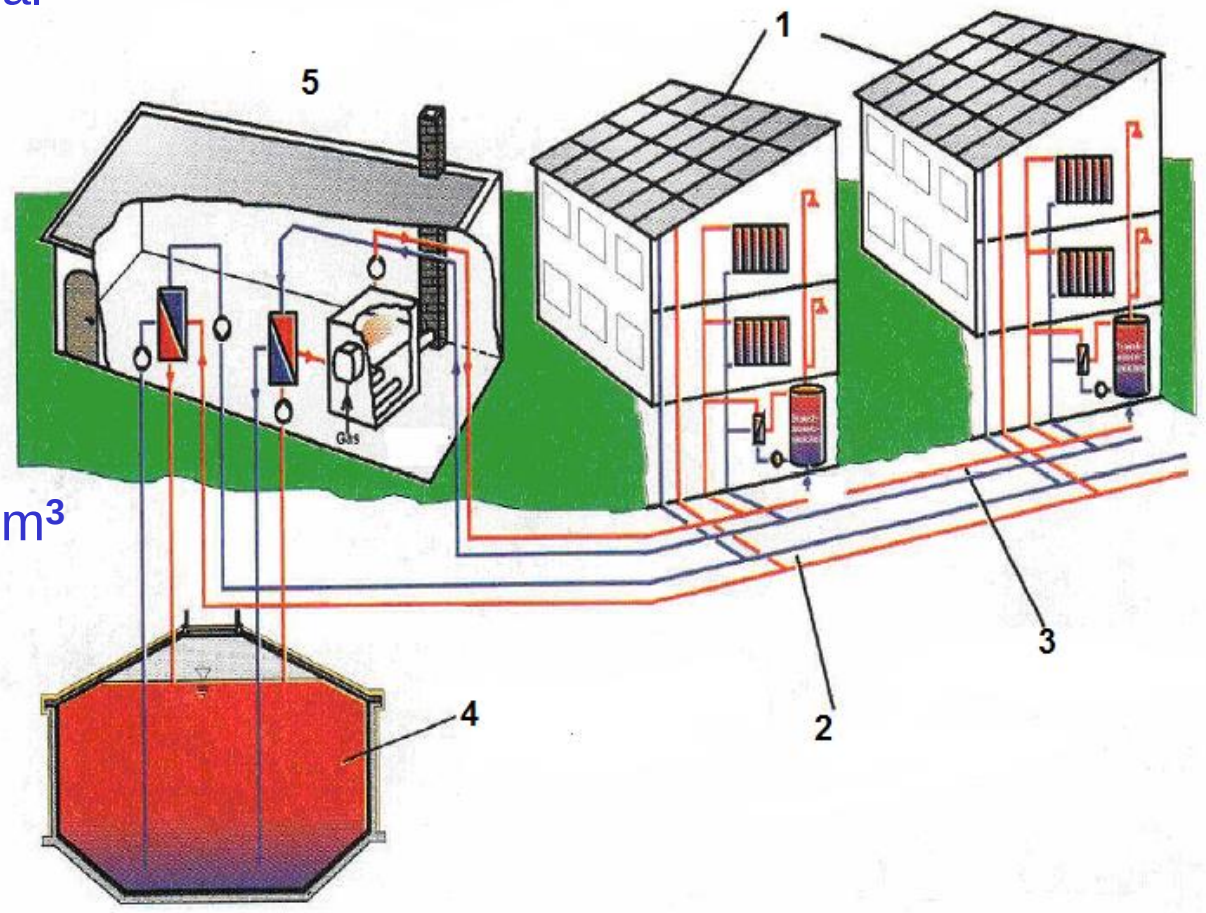
Obstacle height Angle and Azimuth

Solar Thermal at the Neighbourhood Scale

Nearby' or district heating supported by active solar thermal system and seasonal heat storage

Example:
the Friedrichshafen project

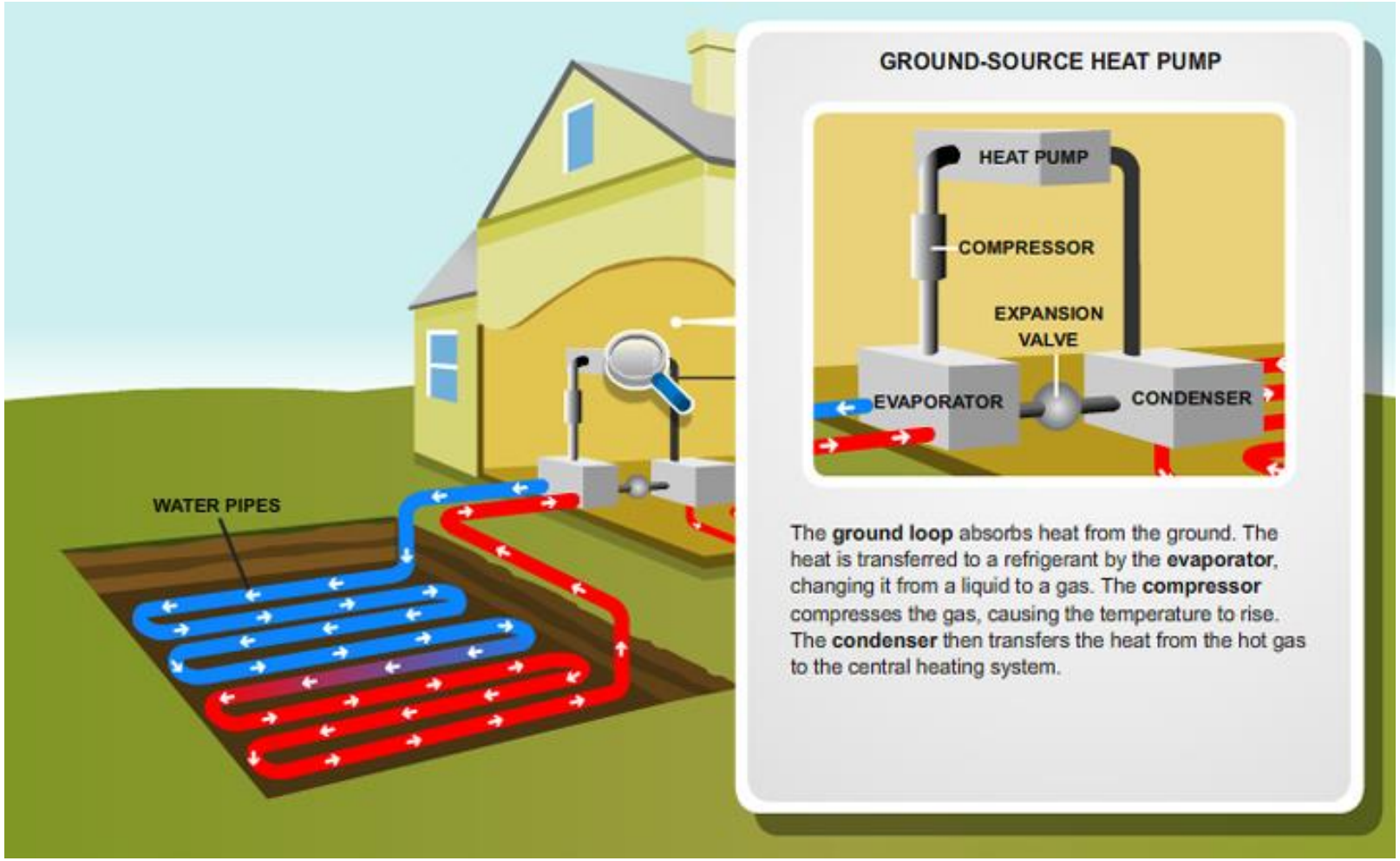
1 Collector array 5600 m²
2 Collector network
3 Heating network
4 Seasonal storage 12000 m³
5 Heating plant



Solar Power: Constraints & Facilitators

Location & Land Use	Landscape & Visual Impact	Site Conditions & Operation	Infrastructure
Most solar installations in use involve integrated microgeneration, i.e. planning permission not required	Not likely to have significant visual impact but assessed on case-by-case basis	N/A	If electricity from PV being exported to the Grid, local authority to provide guidance on location of transformers and cables
Incorporated into facades of buildings	Special provisions for protected structures or in architectural conservation areas.		
LA might want to define type of scheme, e.g. commercial or large-scale			

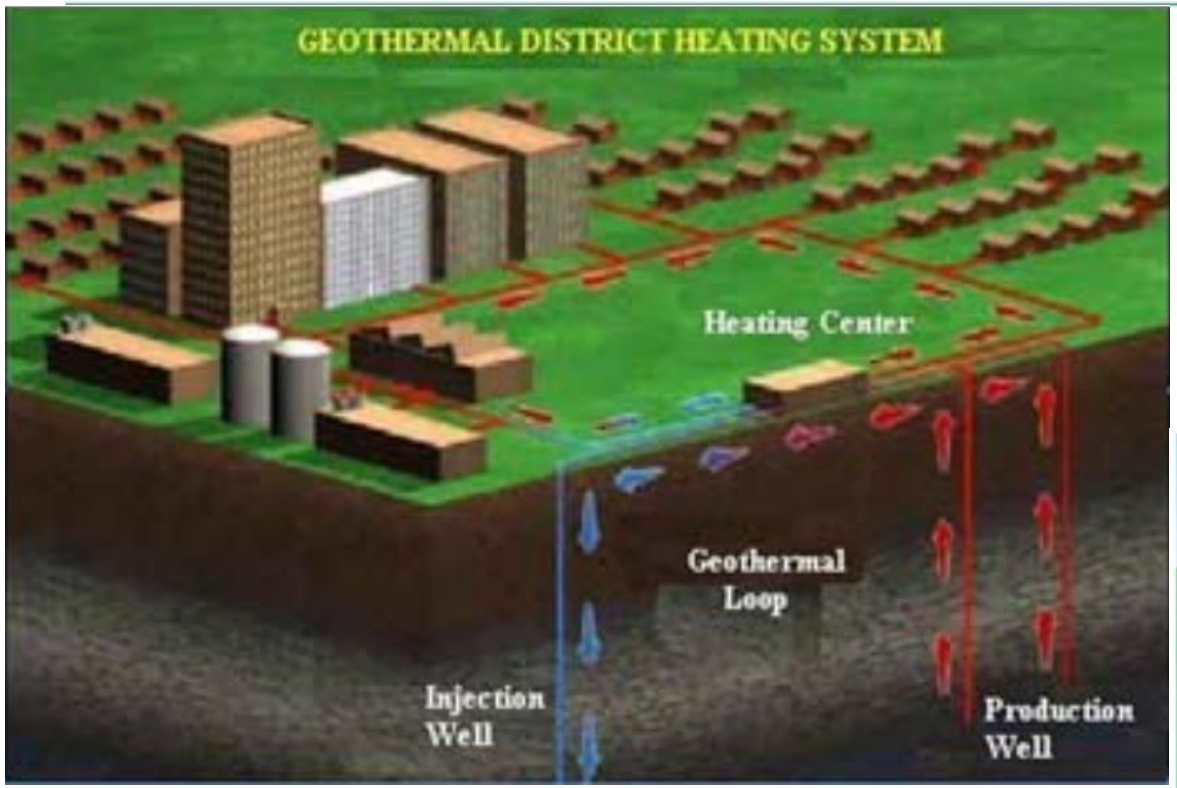
Conversion Technology: Geothermal

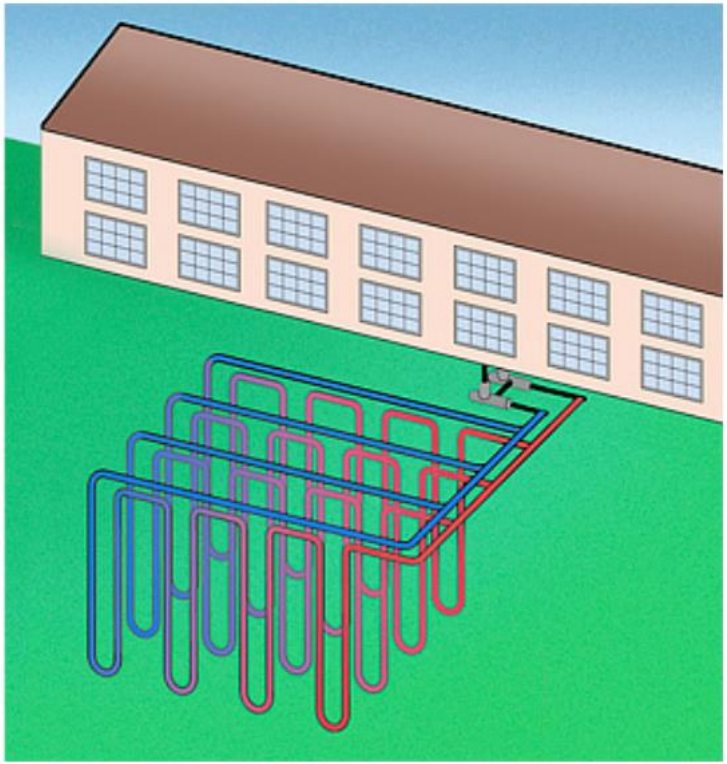


Geothermal: Constraints & Facilitators

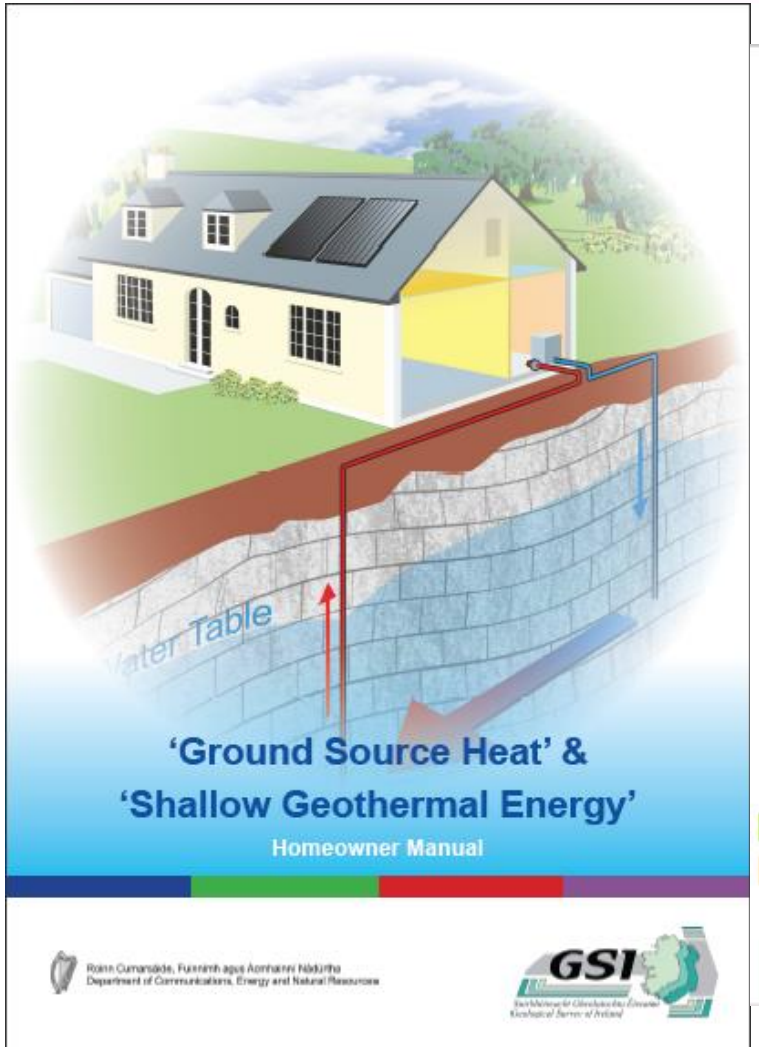
Location & Land Use	Landscape & Visual Impact	Site Conditions & Operation	Infrastructure
May need to consider the possibility of the following issues, depending on whether it is deep or shallow: • Proximity to water resources • Location of unused mining facilities and underground works • Proximity of shallow geothermal systems to each other • Potential of open loop shallow systems in aquifers	Try and maintain as many elements as possible underground to reduce visual impact over ground. Deep geothermal operations may require generation/distribution stations above boreholes Shallow operations can minimise visual impact, e.g. 80 kW closed loop below IKEA car park	Potential issues: • Impact of underground works on surface structures and water sources and the risk of subsidence. • Monitoring of surface and groundwater quality • Seismic factors (drilling near faults etc.) and the use of reservoir stimulation with some technologies • Risks, e.g. pockets of gas • Archaeology • Noise	Consideration to be given to construction and decommissioning access

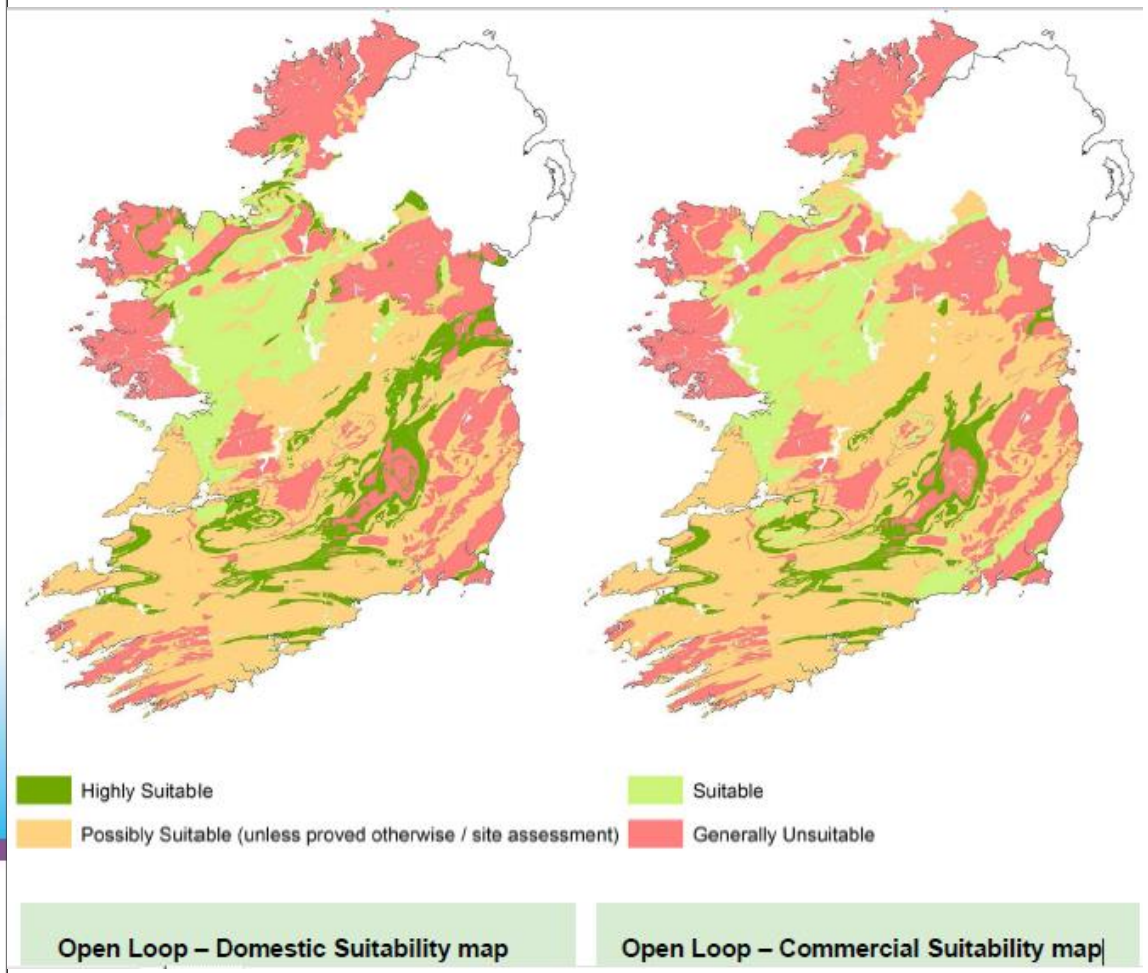
Geothermal: District Heating





Geothermal: New Information Resources





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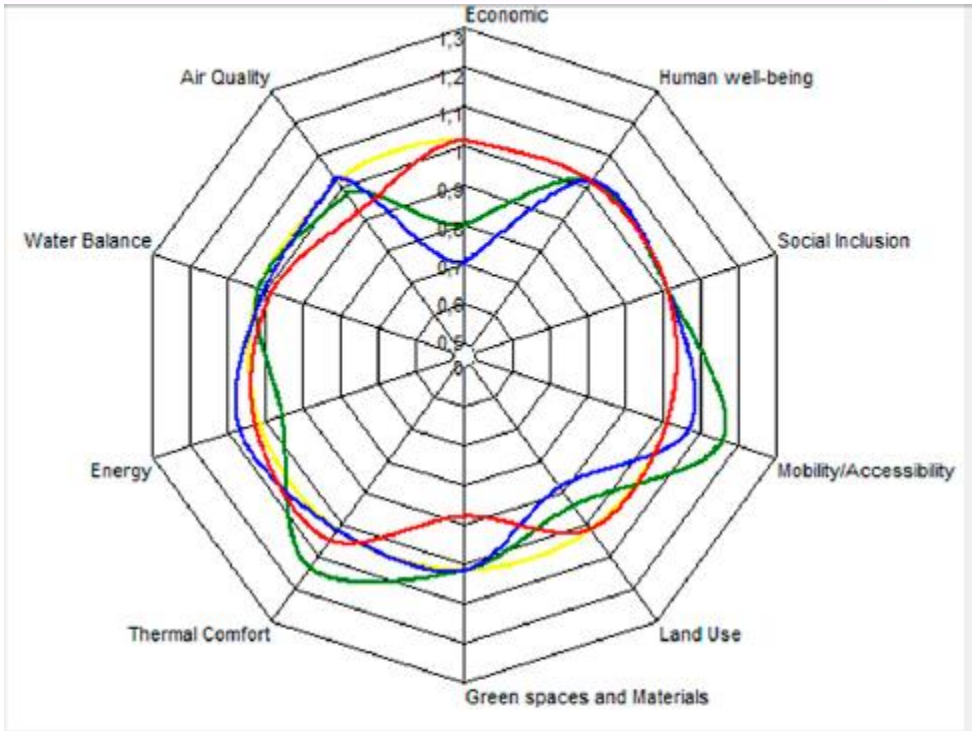
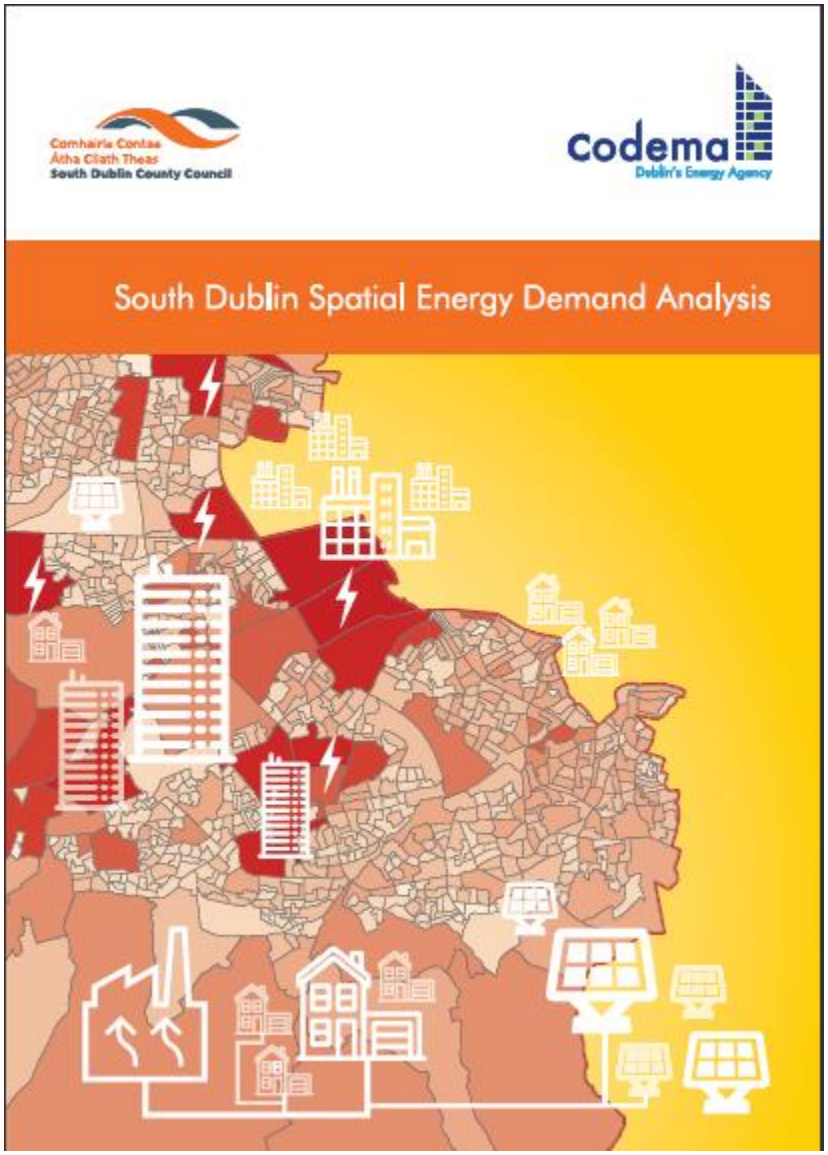
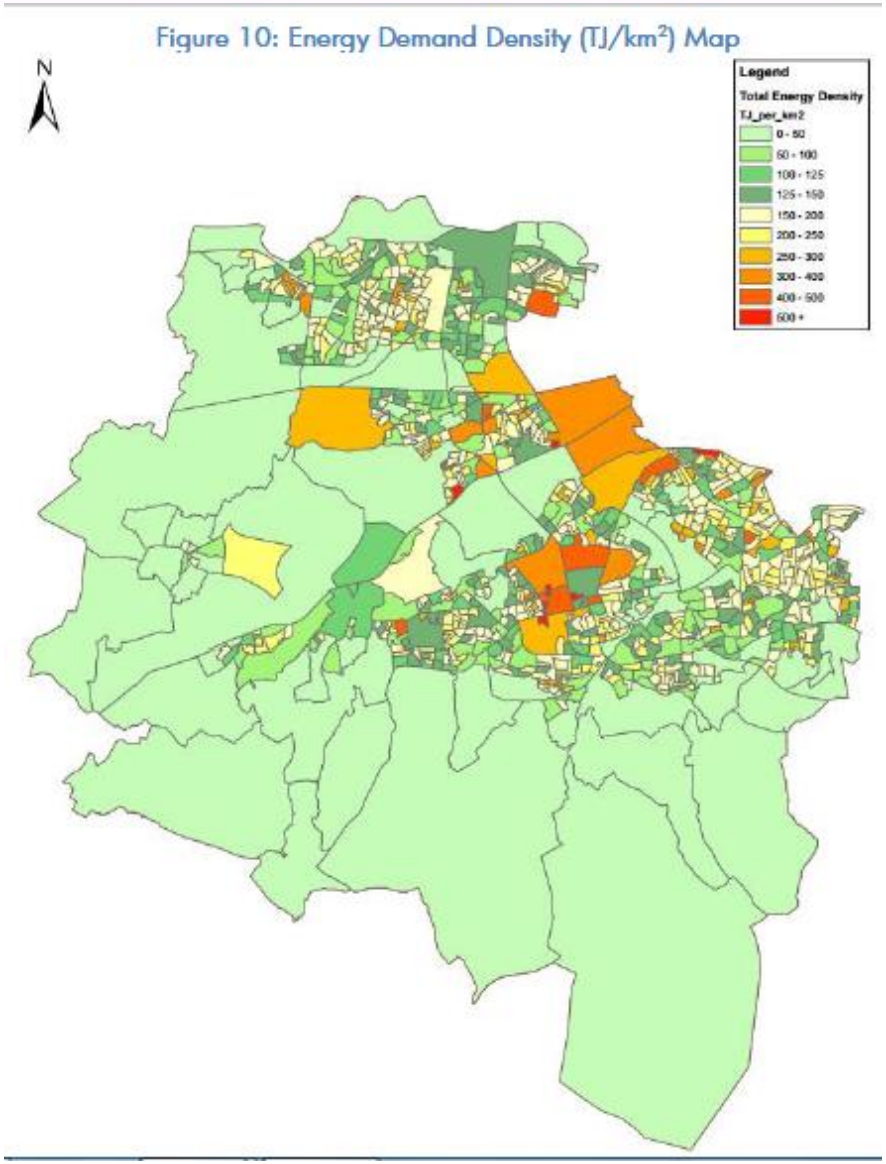
Smart Cities – Integrated Urban Energy Planning



	Base	Alter 1	Alter 2	Alter 3
Enviromental	**1,00**	**1,00**	**1,02**	**0,92**
Air Quality	1,00	0,96	1,01	0,90
Water Balance	1,00	1,00	0,99	0,97
Energy	1,00	0,94	1,05	1,01
Thermal Comfort	1,00	1,12	1,00	1,04
Green spaces and Materials	1,00	1,00	1,00	0,86
Social	**1,00**	**1,02**	**0,97**	**1,00**
Land Use	1,00	0,92	0,87	1,00
Mobility/Accessibility	1,00	1,15	1,06	1,00
Social Inclusion	1,00	1,00	1,00	1,00
Human well-being	1,00	1,00	1,00	1,00

SEAI R,D&D Project Funding: SDCC Energy Demand Analysis





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