Energy in Horticulture

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- Setting the Scene today
- Domestic Pilot Grant Scheme
- Demand Side Assessment - Case Study
- Storage and its role
- RESS/Microgen Supports - Urgency for Auto generation < 1MWh
- Conclusion

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TOWARDS AN ECONOMICS OF ENERGY IN HORTICULTURE

Abstract:

Storck, H. (1978) .

Energy-oriented economic research is needed

1st - to increase the efficiency of an important and increasingly expensive and scarce production means in horticulture under glass in order to improve the financial results of the horticultural firms.

2nd, one needs information and models about the energy flows in horticulture for appraising the welfare benefits of the industry and for evaluating political decisions on energy policy affecting it.

3rd - this research should be seen in the broader framework of an ecology oriented research on horticultural production, processing, and marketing, which takes into account its negative and positive side effects on the environment as well as its requirements for scarce resources

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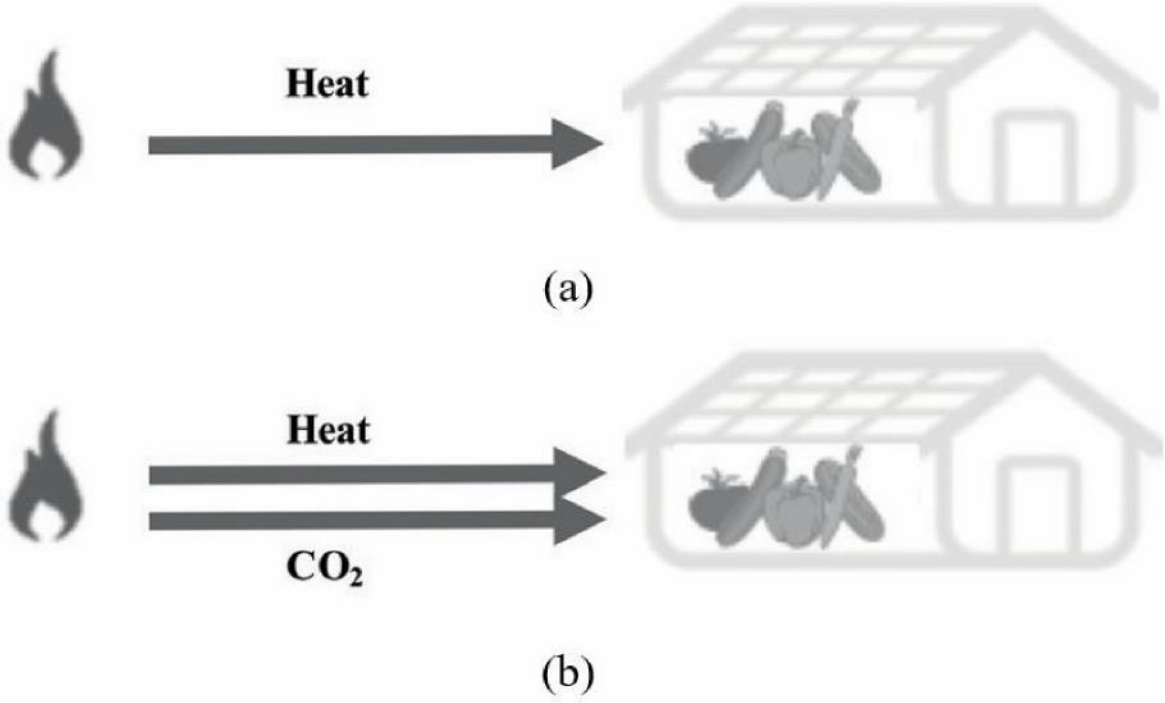

Industrial CO_2

Industrial symbiosis for greener horticulture practices

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Abstract : (B. Marchi[a*], S. Zanoni[a], M. Pasetti[b], 2015)

Carbon dioxide (CO2) enrichment in controlled environmental conditions has proved to enhance the growth and production of a wide variety of crops. Previous studies suggested that the use of this horticulture practice in greenhouses may represent a useful opportunity for the capture and utilization of industrial CO2 emissions. The symbiosis among industrial installations and horticulture facilities may in fact allow to reduce the overall amounts of CO2 released in the atmosphere, by reusing the direct production of carbon dioxide into crop enrichment processes

German Policy vs Irish Policy

Renewable Electricity Generation

- The Renewable Energy Act (German EEG 2017) manages the development of renewable energy sources in Germany. Decision/Policy makers may choose between several business models to Operate Renewable Energy plants
- Rapid shift in policy required
  - Citizens Assembly
  - JOCCAE Report March 2019 Calls for Microgen tariff introduction.

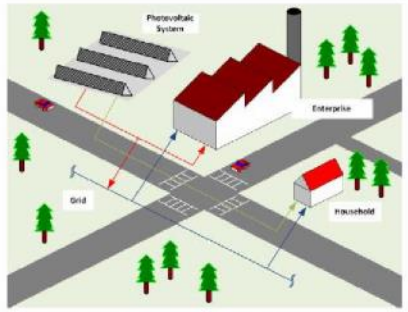

Fig. 3. Overview of the business model 3: Mix of self-consumption, feeding into the grid, and selling to the household.

	Germany	Ireland
Self Consumption	Yes	Yes
Sole feeding to Grid	Yes	No
A mix of both	Yes	No
Selling to 3rd Parties	Yes	No

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Connecting to ESB Networks Grid

- How many Kilowatts/MW of generation are you connecting?
- Do you want to export from the site?
- No Supports for Export at Microgen Level

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Connection Offer Process - Micro Generation

Connection Offer Process - Parallel Generation

Zero Export Process

Generators with not export capacity are generally referred to as Paralleled Generators

Apply to ESB Networks using the NC5 application

There is currently no charge to apply to connect a zero export generator

A quote and connection agreement should be issued by ESB Networks within 30 days.

The installation must comply with ESB Network protection requirements

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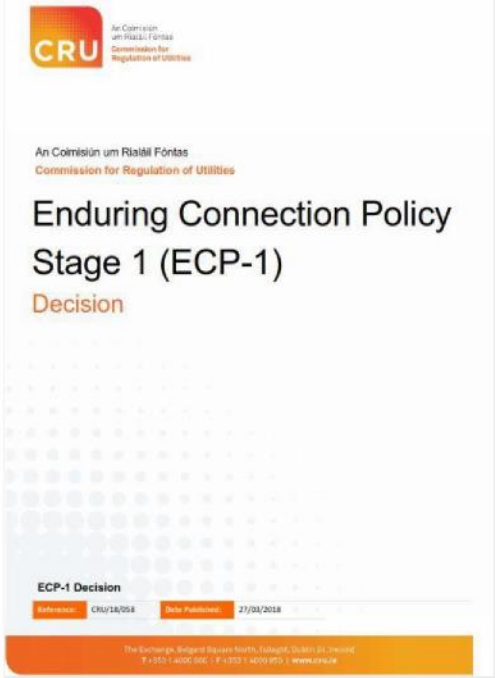

ECP Connection Offer Process

- **≤500kW Export Capacity**
- Small projects 11-500kW and auto production can be processed individually
- Capped at 30 offers in a calendaryear
- Planning permission is a requirement to apply
- Application fees apply
- Auto-production clearly defined as demand sites with generation where MEC is less than 2 times the MIC

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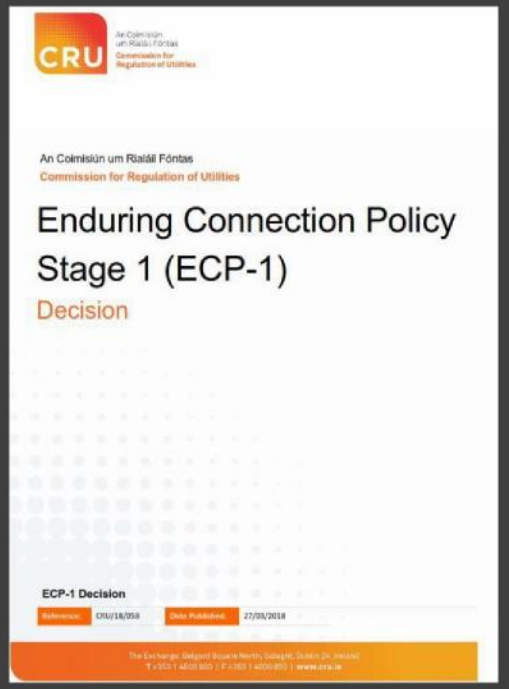

>500kW Export Capacity

Need planning permission to apply for batch processing

Grid Connection Application using NC5 export. Application fees apply 46% increase from 2017

42% increase in Grid Connection Costs from 2018 vs 2017

Processed in a batch with other applications

Expectation to have a batch every two years using the RESS Auctions. Technology Neutral

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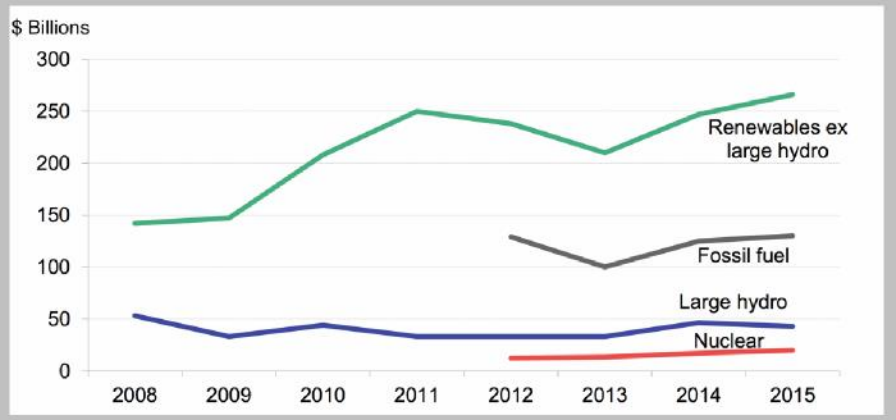
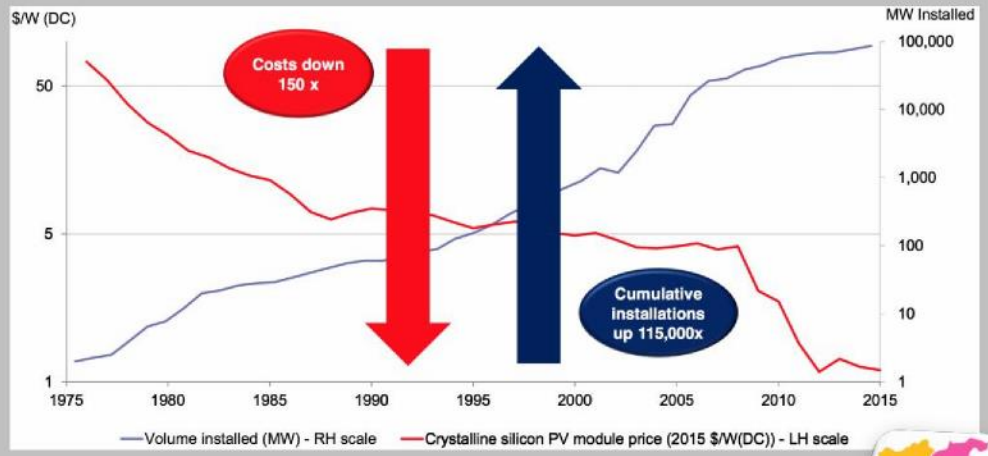
Renewable Energy the new reality

- Renewable energy is now the cheapest form of electricity generation in many countries (LCOE)
- Extraordinary growth in installations has driven significant price reductions
- Currently twice as much annual global investment in clean energy as fossil fuels so further cost reduction expected
- All this investment growth despite current low oil & gas & coal prices





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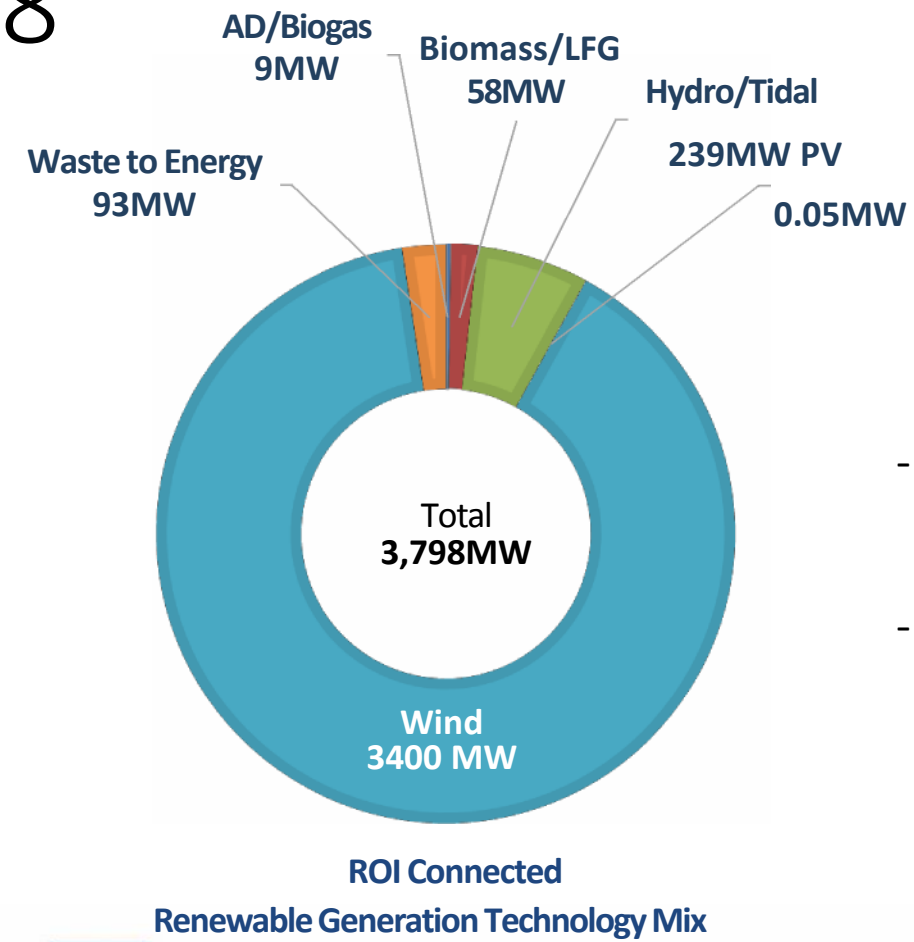
Renewable Connection Status Ireland 2018



ROI Connected
Renewable Generation Technology Mix

- 12,000 GWHr of renewables energy required to meet 2020 targets

- RESS paper proposes another 11,000GWhr required by 2020

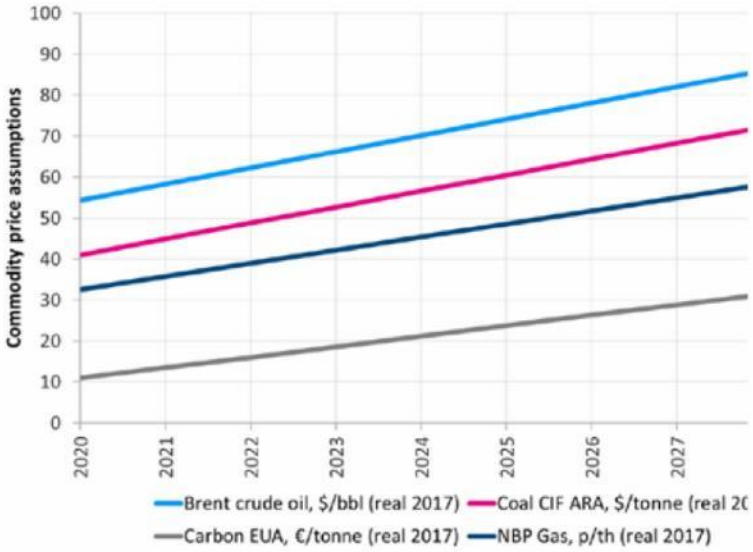
- That only gets us to 55% renewables

Table 4 Key scenario assumptions All-Island

	2020 Assumptions	Fossil Fuel 2030	Renewable Energy 2030
% RES-E	41%	37%	70%
% RES	13%	15%	25%
Total Electricity Demand (TWh)	40	46	49
Wind Power (MW)	5,400[8]	5,400	10,190
Solar Power (MW)	320	320	2,900
Interconnection (MW) – All Island	580	580	2,030
SNSP Limit – All Island	75%	75%	90%
Min Gen (MW) – All Island	1,000	1,000	700
Electric Vehicles (nr)	0	0	629,398
Heat Pumps (nr)	0	0	396,302
Small Scale Battery Storage (MW)	0	0	500
Large Scale Battery Storage (MW)	0	0	1,200

[8] For modelling purposes, we have assumed an average availability of 35% for onshore wind in all years of the study. Actual onshore wind availability is currently lower than this, as the existing wind fleet was installed over a 25-year period. In order to match near term renewable energy generation accurately, we have modelled onshore wind installed capacity in NI of 1,100 MW in 2020, at the higher assumed load factor of 35%.

gure 3 Commodity and carbon price assumptions



IWEA Baringa Report Suggests 70% Renewable Electricity by 2030
Supported by
Renewable Energy Ireland
Joined up lobbying having an impact
IWEA, IWFA, IRBEA, ISEA and Offshore Wind Associations (Formed q1 2019)

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Solar Energy in Ireland

- Solar resource in Ireland is comparable with Germany & UK
  - Solar PV not competitive with onshore wind but moving up the merit order
    - Energy White Paper (Dec 15) states "*…as new renewable energy solutions such as ~ solar PV.. become more cost competitive they will be included in the renewable energy mix*"
  - Consultation on next renewable support scheme ongoing & solar support tariff widely anticipated
  - Struggle to reach RES-E 2020 target with shortfalls likely in RES-H & RES-T

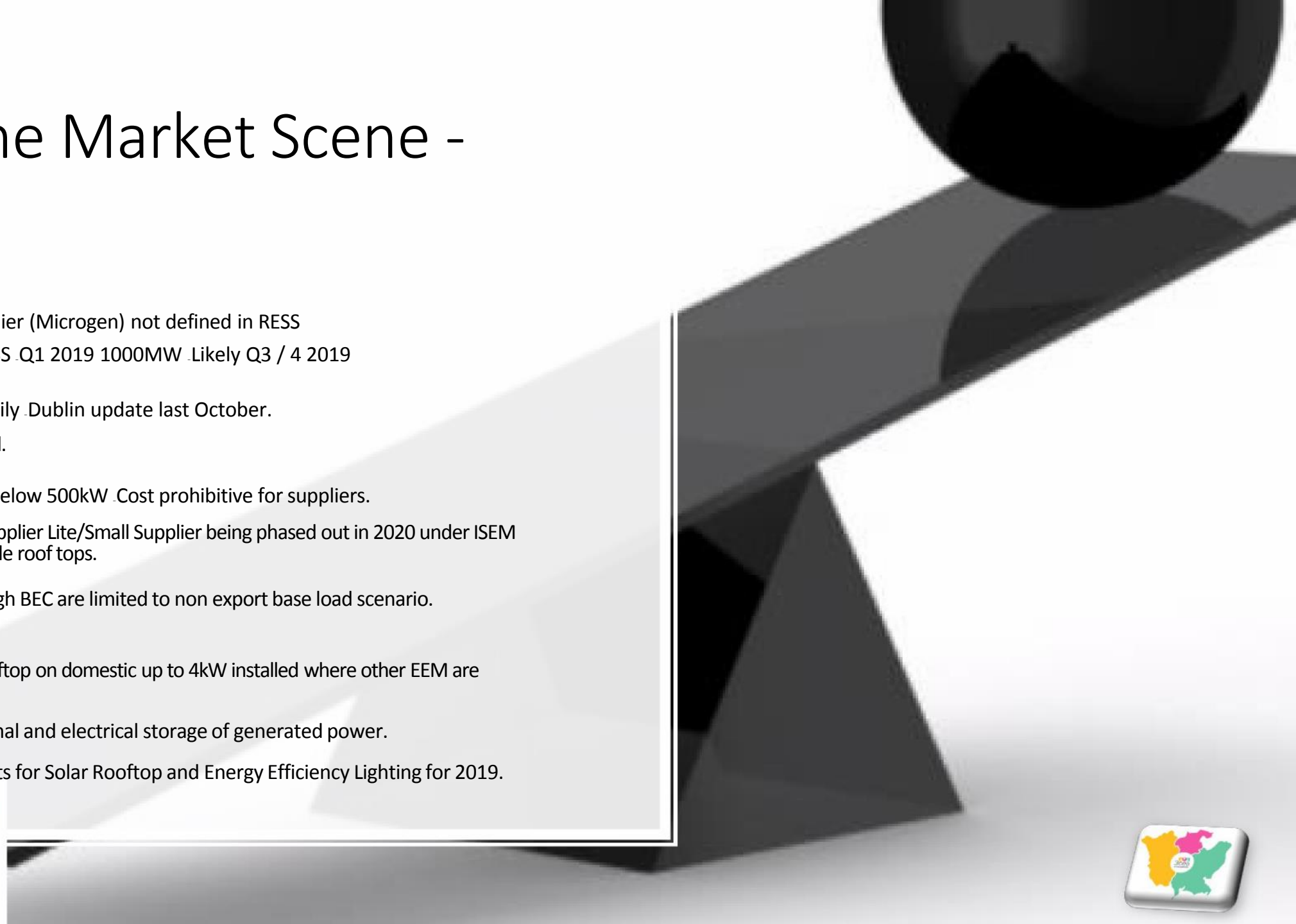
Setting the Market Scene - Logic?

Against

- No FIP or FIT Small Supplier (Microgen) not defined in RESS
- Proposed Auction in RESS Q1 2019 1000MW Likely Q3 / 4 2019
- NEW ECP 1 Changing Daily Dublin update last October.
- Private Wire not permitted.
- PPA difficult to procure below 500kW Cost prohibitive for suppliers.
    - Negative demand/Supplier Lite/Small Supplier being phased out in 2020 under ISEM removing options to bundle roof tops.
- SEAI Energy Grants through BEC are limited to non export base load scenario.

For

- SEAI have grant aided Rooftop on domestic up to 4kW installed where other EEM are completed in tandem.
- Options to consider thermal and electrical storage of generated power.
- TAMS announced supports for Solar Rooftop and Energy Efficiency Lighting for 2019.



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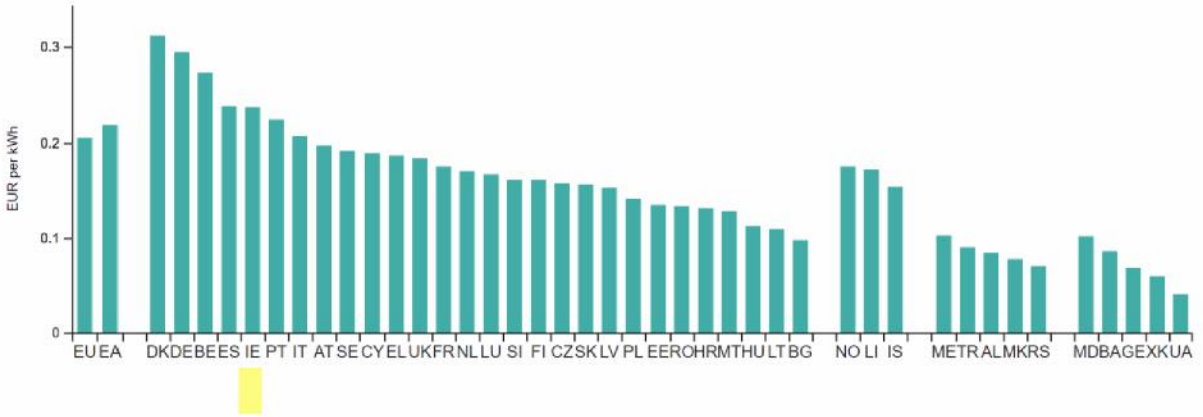
EU Electricity Price - Domestic Q1 2018

- Ireland 5th highest of EU 28 (27 ?)
- 0.2369c per kWh
- Opportunity perhaps for rooftop export is high where offsetting baseload.

Tweet Household electricity prices in the EU highest in Denmark (EUR 0.31 per kWh) and lowest in Bulgaria (EUR 0.10 per kWh) during the first half of 2018.

Tweet Non-household electricity prices in the EU highest in Germany (EUR 0.15 per kWh) and lowest in Finland (EUR 0.07 per kWh) during the first half of 2018.

Electricity prices for household consumers (taxes included), first half 2018 (EUR per kWh)



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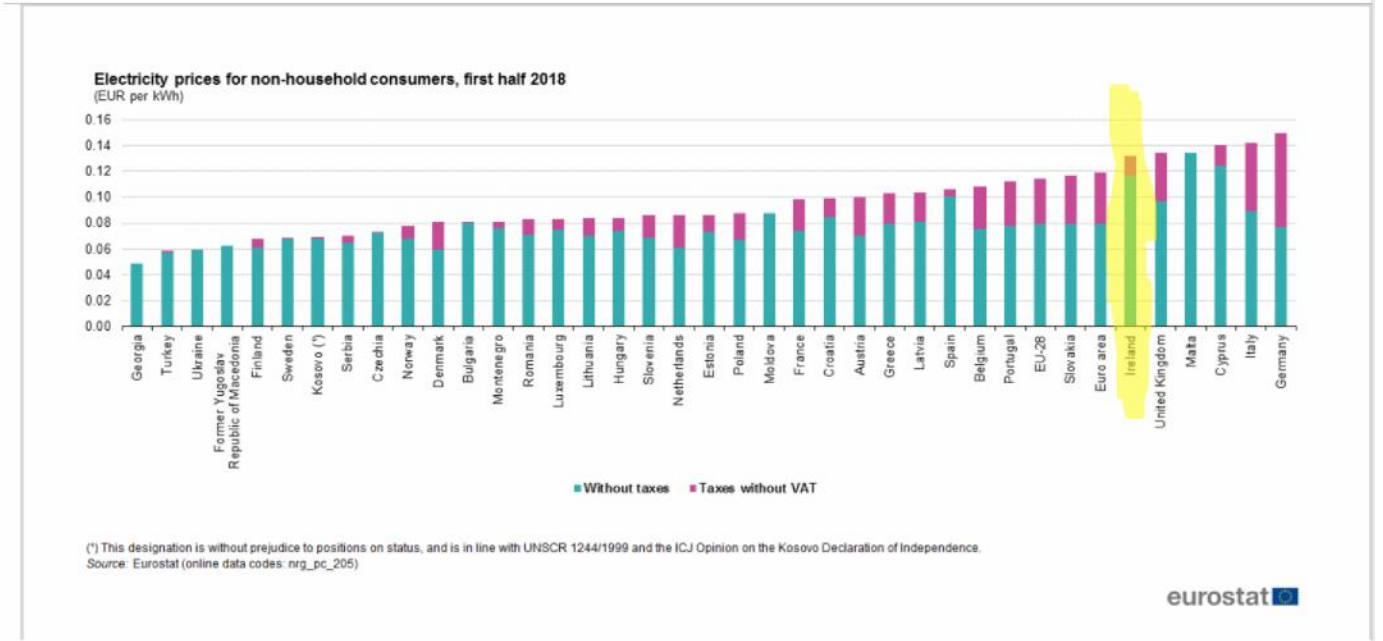
EU Electricity Price Non Domestic Q1 2018



- Ireland 6^{sr} highest of EU 28 (27 ?) €0.135c
- Opportunity perhaps for rooftop to offset summer demand prices?
- No export tariff on offer for Microgen – suggestions coming in late 2019/2020 Mean
- time 30% grant from BEC or 40% Grant from Tams

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Domestic PV Grant Scheme

seai SUSTAINABLE ENERGY AUTHORITY OF IRELAND

driving sustainability

- SEAI offer homeowners a grant of up to €3,800 to support the installation of Solar PV panels and battery energy storage systems.
- This will reduce the electricity you currently purchase from your supplier and save you money. It is desirable to maximise the amount of solar electricity you use in your home by sizing the solar PV system to meet your demand, and by using energy storage solutions. Support is available to all owners of dwellings **built and occupied before 2011.**
- The grant is available for all new Solar PV installations from Tuesday 31st July 2018.

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p up to max 4kWp. Any installation over a battery.

Grant amounts available

Solar PV	Battery Storage System
€700/kWp	€1,000

The benefits

Cheaper electricity bills

On average, a solar PV system can save between €200-€300 per year on your domestic electricity bill. This will make a big difference to you household running costs, allowing you to save for what really matters..

Improve your BER

By investing in solar PV, you will also be making an impact on the BER of your home. When it comes to selling your home, a higher BER will add value and help you achieve a higher sale price.

Reduce your emissions

Generating your own renewable electricity also has benefits for our environment. The energy you consume will be clean energy which cuts down on your greenhouse gas emissions.

Pilot Phase to Inform the PV market.

- €700 for every kWp up to max 4kWp. Any installation over 2kWp must install a battery.
- Any PV system on domestic has to achieve planning for system above 1.8kWh and or that covers more than 50% of the roof.
- Costings are high presently. Value should be sought. Price of panels is falling around the world

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Case study 1 : Fitzgerald nurseries

Fitzgerald Nurseries are a specialist “trade only” nursery that produces and delivers young plants as plugs liners and stage 3 tissue culture worldwide from Stonyford Co. Kilkenny.

- Strategy Set in 2015 with CKEA
- Phase 1 : Efficiency
- Phase 2: Expansion of Production.
- Phase 3 : Implement Renewables.

- 30% Grant with CKEA in 2016 for Heating Upgrade.

- TAMS grants available to 40% for certain qualifying technologies 2019

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Case study 1 : Fitzgerald nurseries

- Restricted Yield from available heat from existing heating system cost.
- Space Heated to 20 degrees C all year round.
- Total Energy Consumption pre retrofit was 1,295,000 kWh of which 1,125,000 was thermal load.

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Case study 1 : Fitzgerald nurseries

- Two 250 kW Oil Boilers at circa 70% Operational Efficiency
- Burning 85,000 litres in Nov ‘15 to June ’16

- Limited Capacity to Deliver heat at peak demand.

- Little or no buffer storage.

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Case study 1 : Fitzgerald nurseries

- Condensing Gas Boilers
- Robur Gas Absorption Heat Pumps mounted on a skid
- Thermal Storage
- Metering & Monitoring of all energy inputs & outputs
- Web Enabled Smart Control System

Case study 1 : Fitzgerald nurseries Q1&1 ’17

Plant production increased times 4 with €8,900 saving on energy.

	Delivered Energy kWh	Primary Energy kWh
Electricity before	36,863	92,157
Thermal before	1,258,344	1,258,344
Electricity after	48,065	120,162
Thermal after	1,124,271	1,124,271
Total before	1,295,207	1,350,501
Total after	1,172,336	1,244,433
Savings	122,871	106,068
Savings Energy Spend	€ 8,900	Plant Production up by 4 fold

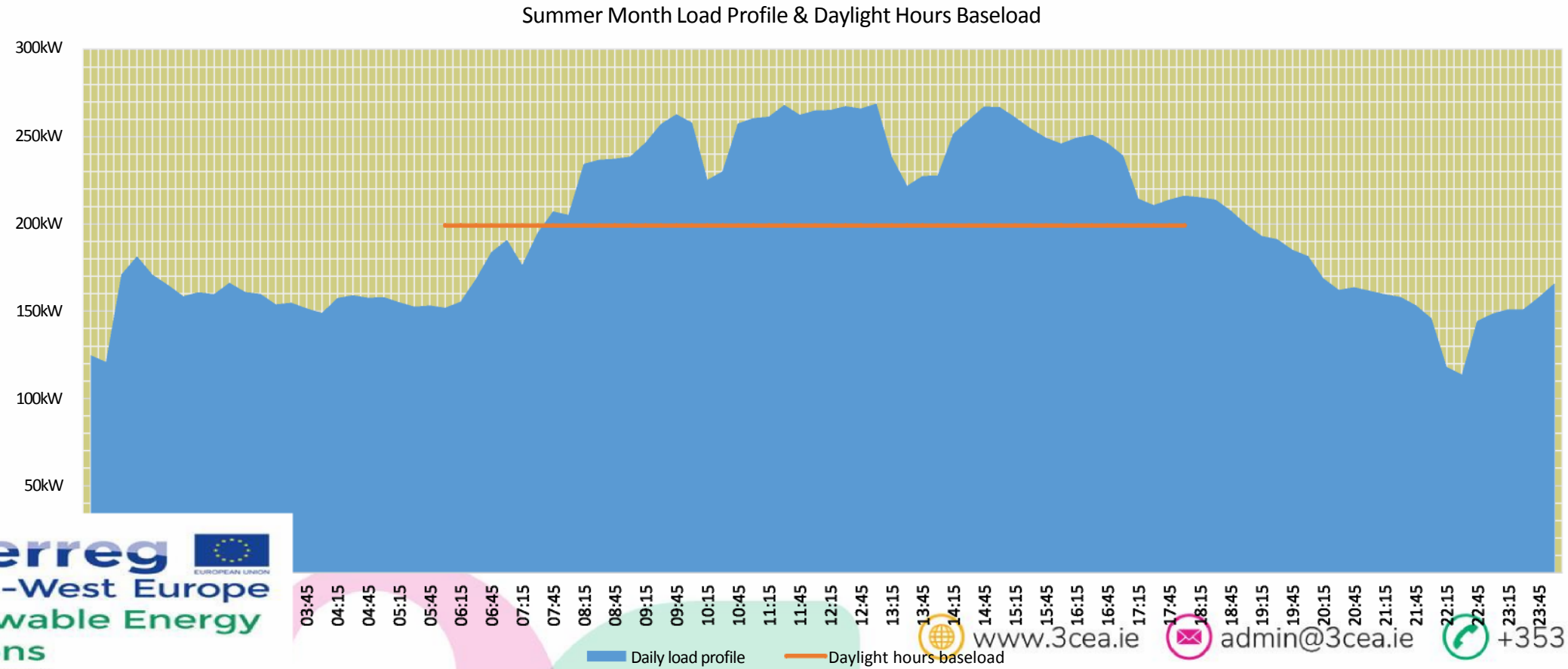
- 4 kW with 5kWh battery system c. €11,200 excl. VAT.
- 8.1 kW, no storage €11,000 ex VAT
- 9.54 kWp with 10 kW storage €24,698 incl. VAT, PM fees & M+V
  - €24,698
  - Grant €7,409.40 @ 30%
  - Payback <10 years
- Typically range from €800 to €1,400 per kWp for large scale rooftop

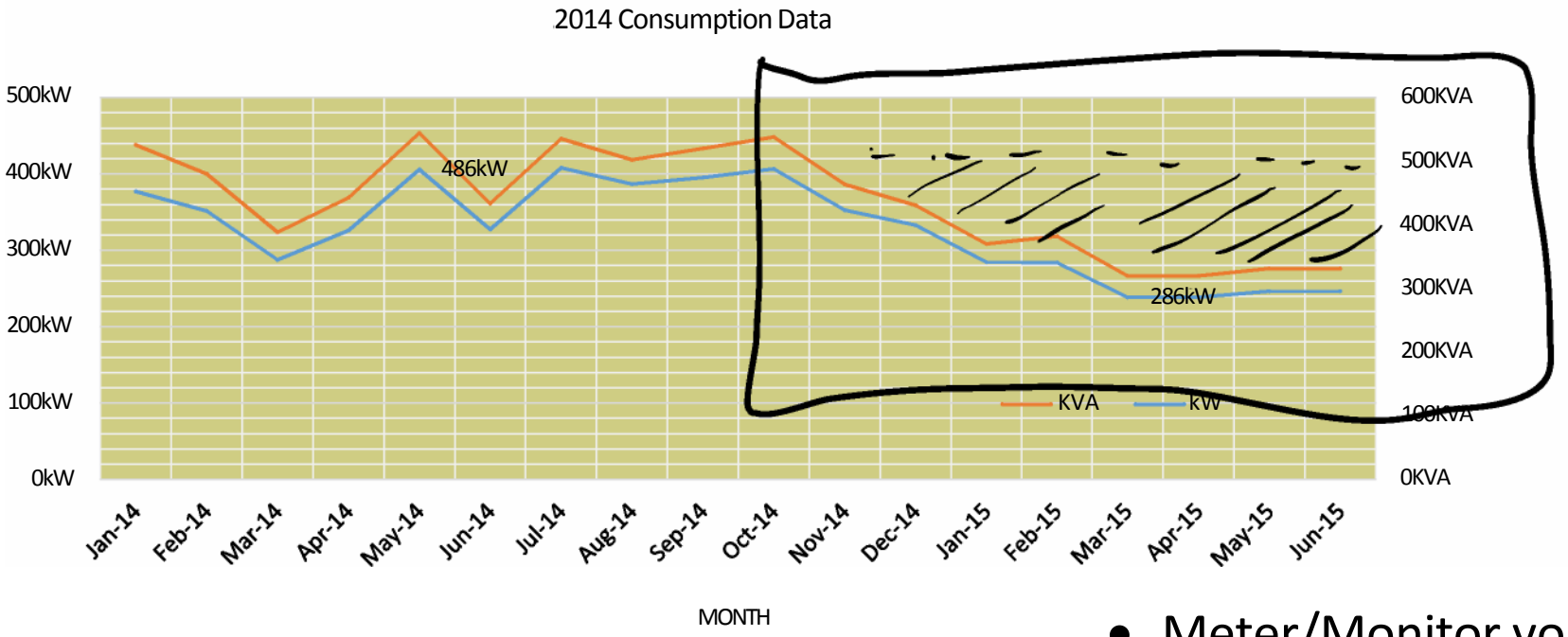
Case Study 2: Solar with Battery Dairy 2018

Full Year Data Q3 2019

Waiting to See??!!!!!

What are your limitations!

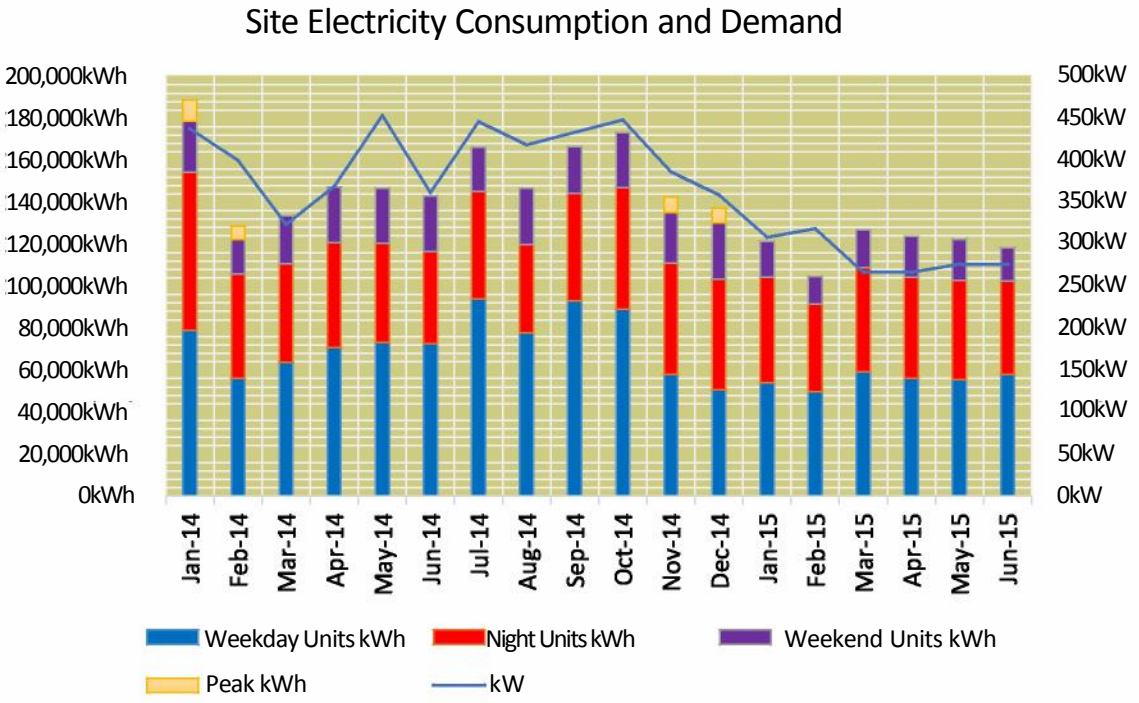


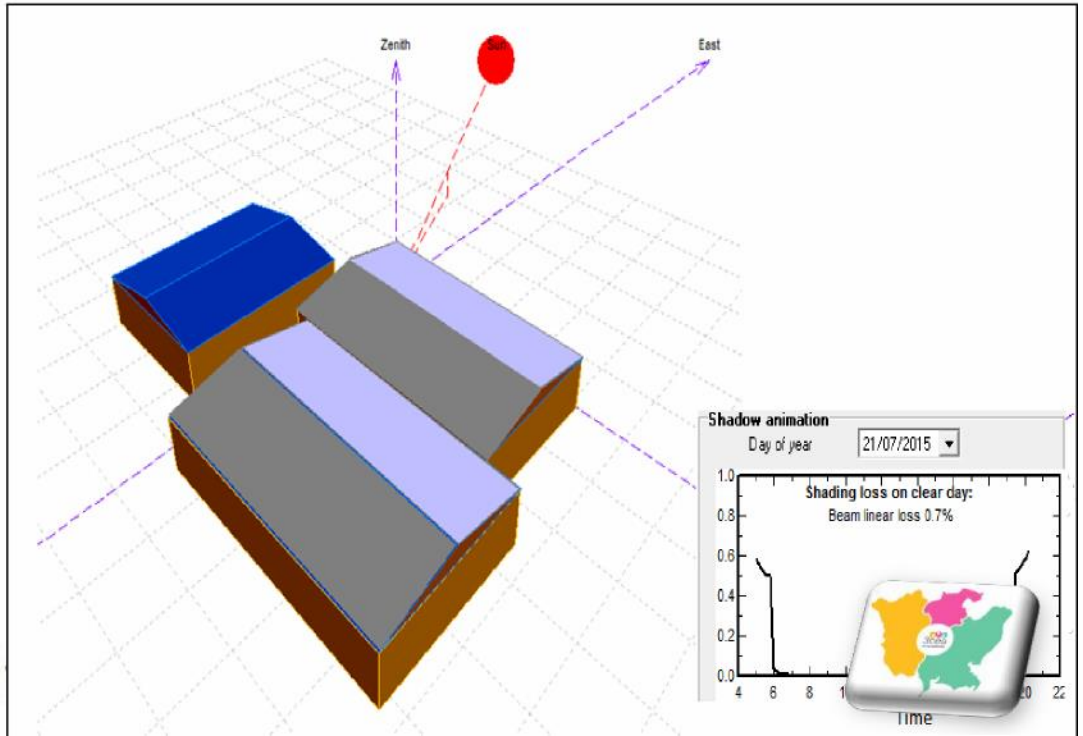


Case Study 2: What Demand Works?

- Meter/Monitor your total annual demand
- Understand Energy Efficiency reduces demand as step 1 .Demand reduced in 2014 with VSD & Lighting retrofit
- Design your array to meet your lowest desired base load without impacting your activity matrix (e.g. maintain volume of widgets produced.) Base Load 250kW
- Thus avoiding export!!!

Case Study 2 Where is your target load? Know Before you Tender?





Ground Mounted

- 25 acres = 5MW
- 100 acres = 20MW
- 250 acres = 50MW

- Process
  - Planning
  - Grid
  - Connection fee
  - Finance
  - Construction
  - Commission
  - Trade

If you are thinking of developing solar …

- Understand the risks and establish the facts .land, resource, grid capacity, planning
- Identify options .develop, co-develop, lease land to developer
- Budget .costs for development, pre-construction & construction
- Stay up to date on industry developments including support scheme and relevant regulations
- Be realistic .energy projects are long term projects & solar is a low margin business

unity participation

Conclusion – Ireland Inc. Needs to get the wheel back on renewables support for Agriculture!

- Irish policy direction towards increased renewable energy is clear for large scale renewables. Not for small scale or SME.
- Solar PV and Wind are the dominant renewable technologies
- Solar PV makes sense as part of the Irish energy mix
- Wind & solar have synergies which may be captured by existing windfarms if the correct regulatory framework is put in place

Value for Money by Group Purchasing or Discussion

- Aggregation of multi owner projects is what we are good at to deliver the independent technical, quality and price for the end user.
- Trusted intermediary of a regional energy agency to advise independently of your best options in Energy Efficiency and Renewables.
- 3cea will have a Framework of pre qualified suppliers suppliers competing on price to deliver Solar PV
- Currently delivered in excess of 2MW roof top in BEC Grant programme In absence of supports Demand led approach only option with 6-10 yr payback depending on your current day rate unit cost of electricity.

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