



Horticulture 4.0 Conference



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Energy

What – How – Where – When

...Next

Tim Pratt

Technical Director

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1. **Reliable**
2. **Renewable / low CO₂**
3. **Cheap**
4. **Greenhouses also want CO₂**

**Protected
horticulture has an
energy “quadlema”**



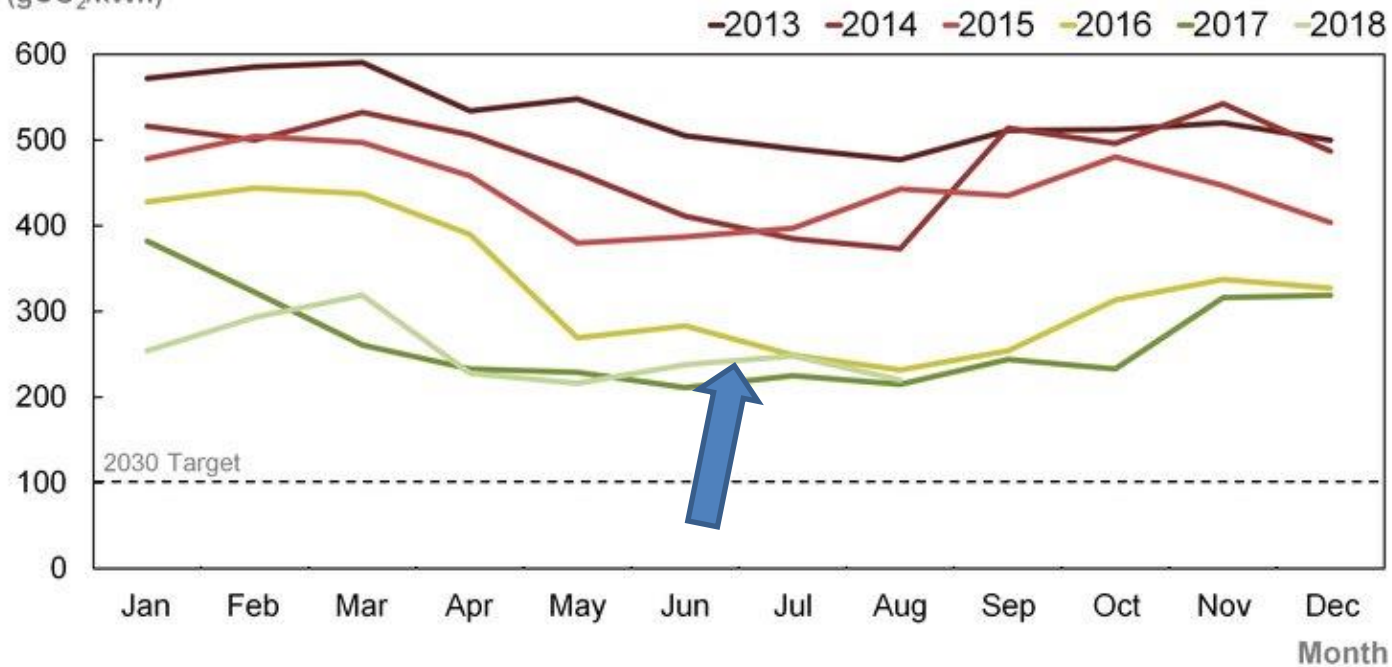
- **Electricity**
- **Heat**
- **CO₂**
- **The greenhouse of the future**



The Decarbonisation of British Electricity

2018 has so far been the 'greenest' year on record in Great Britain

Carbon Intensity
(gCO₂/kWh)



49.7% decrease
from 2013 to 2017

2013 **529** gCO₂/kWh

2014 **477** gCO₂/kWh

2015 **443** gCO₂/kWh

2016 **330** gCO₂/kWh

2017 **266** gCO₂/kWh

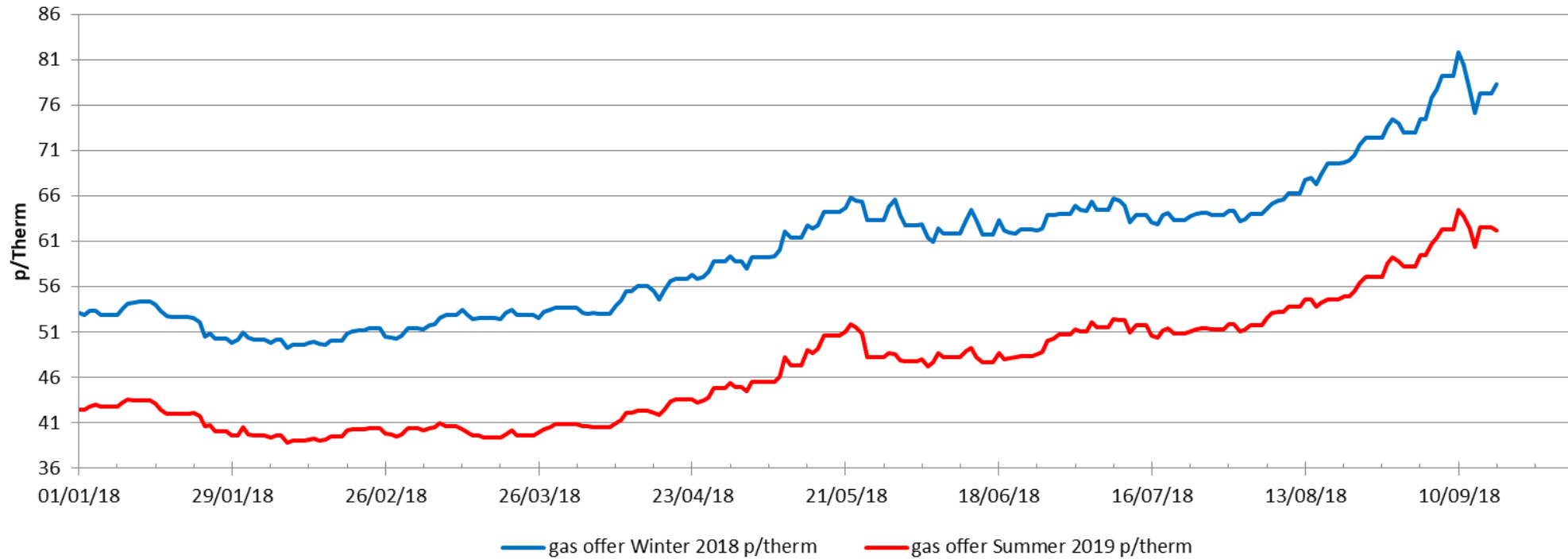
2018 **252** gCO₂/kWh*
year to date

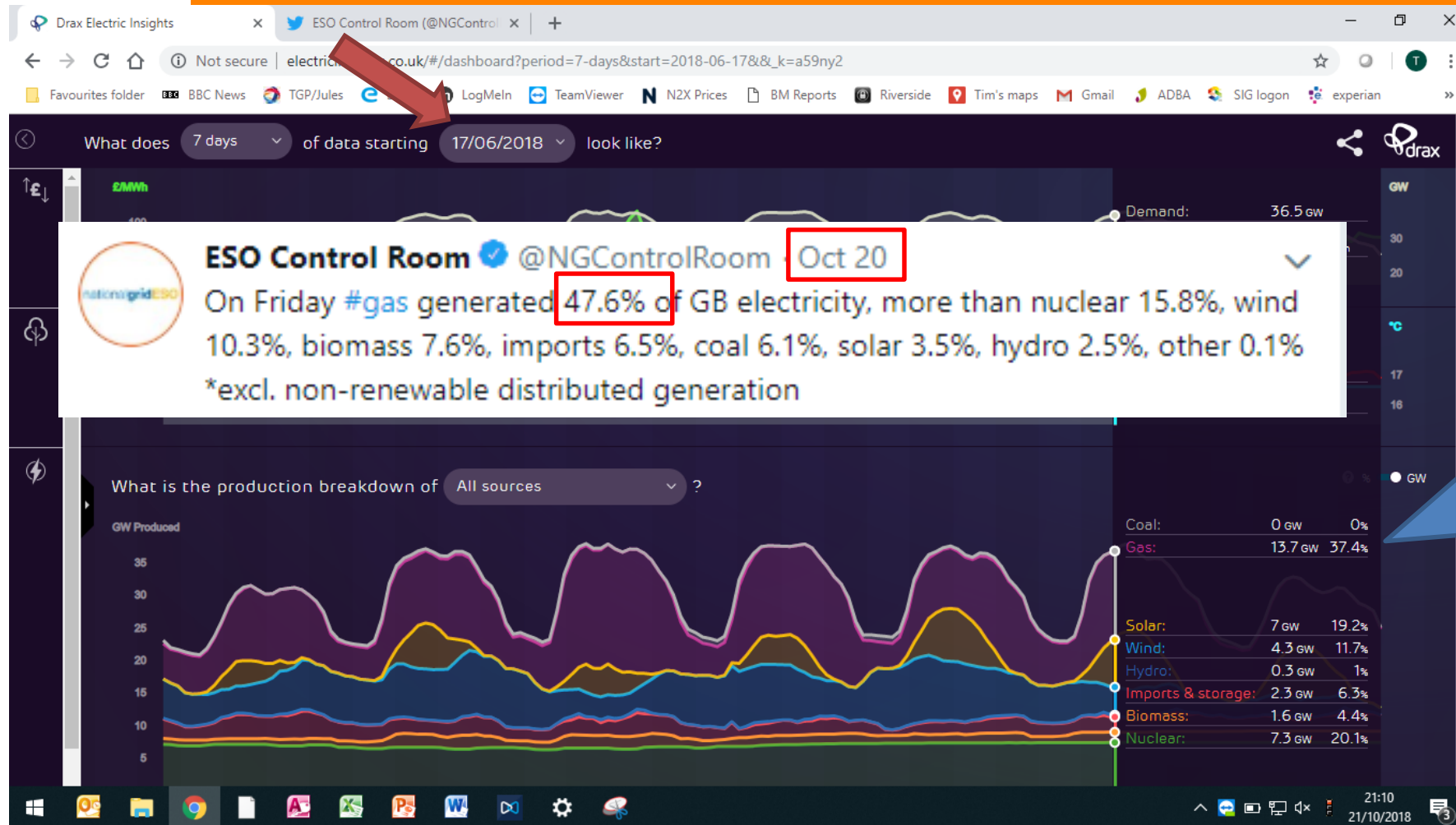
nationalgrid | nationalgrid.com/uk

Source: National Grid



Whole Season Prices





Natural gas
37%



- The 'green effect'

Day (07:00-24:00)	01/10/11	31/10/11	5,701.60	kWh	5.3615p
Night (00:00-07:00)	01/10/11	31/10/11	4,492.30	kWh	5.3615p
Standing Charge	01/10/11	31/10/11	1.00	Month	£17.25
DUoS Capacity Charge				kVA/Month	£0.44
DUoS Standing Charge				Month	£25.54
DUoS Unit Charge				kWh	0.0110p
DUoS Unit Charge				kWh	0.3560p
DUoS Unit Charge				kWh	5.3410p
DUoS Unit Charge				kWh	5.3615p
Distribution Losses				Day	£0.44
Transmission Charge Estimate	01/10/11	31/10/11	103.51	kWh	5.3615p
Transmission Losses	01/10/11	31/10/11	10,558.84	kWh	1.7000p
BSUoS Charge	01/10/11	31/10/11	10,455.33	kWh	0.0163p
Hydro Benefit Charge	01/10/11	31/10/11	10,193.90	kWh	0.0003p
BSC Charge	01/10/11	31/10/11	10,193.90	kWh	0.4798p
Renewable Obligations Charge	01/10/11	31/10/11	10,193.90	kWh	0.0325p
Feed in Tariff	01/10/11	31/10/11	1.00	Month	£2.92
Settlement Charge	01/10/11	31/10/11			

Now – total of 2.8p/kWh

Oct 2011 – total
0.5p/kWh

July 2017 – total
2.4p/kWh

Renewable Obligations Charge	01/07/17	31/07/17	9,401.60	kWh	1.8642p
Feed In Tariff	01/07/17	31/07/17	9,401.60	kWh	0.5830p



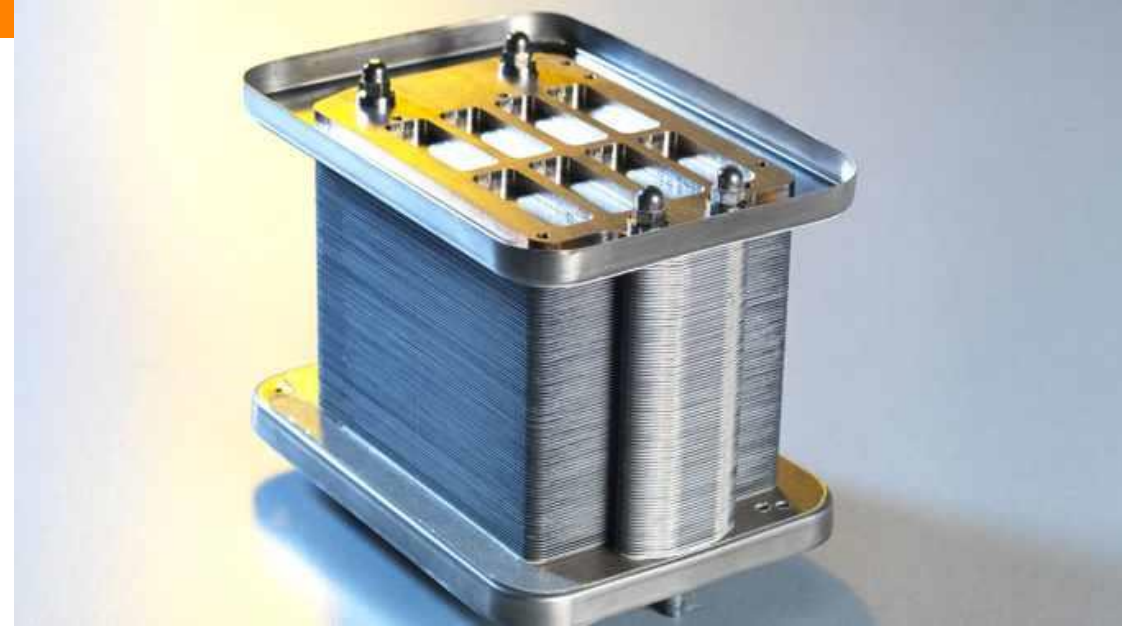
- **Renewables**
- **Batteries**
 - Not bulk storage (yet)
 - Grid balancing



- **Conventional power station**
 - 40% efficient
- **60% is heat – thrown away!**
- **Don't forget Combined Heat & Power**
 - Overall efficiency of >80%
 - CO₂ can also be used to grow food
- **But the fiscal recognition of this is minimal**



- **Fuel Cells?**
- **Not just Hydrogen**
- **Also Methane**
 - 50% electrical efficiency
 - + heat = total efficiency c. 90%
 - CO₂ without a catalyst
 - No NO_x



- **Renewable Heat Incentive (RHI)**
 - Biomass boilers everywhere
 - Heat pumps are increasingly popular
- **But – RHI closes in March 2020**
- **CO₂ for greenhouse enrichment remains a challenge**



- **Anaerobic Digestion**
 - A means to low carbon truly 'natural' gas
- **Biomethane RHI tariff 5.6p/kWh**
 - Equates to £280 per tonne of natural gas CO₂ saved
 - If only there was a Renewable CO₂ Incentive.....



- **Burn gas in a boiler**
 - Throw the heat away
 - Summer 2019 @ 60p/Th
 - Cost of CO₂ = £111/t
- **Burn gas in a CHP**
 - Throw the heat away
 - Sell electricity
 - Cost of CO₂ = £10/t
- **Operating cost only (both)**



- **Carbon capture technology**
 - Current research focus is on fossil fuels
- **It is technically possible to capture CO₂ from a biomass boiler**
 - The costs make it not possible!
- **It is possible to capture CO₂ from an AD plant**
 - Sorry, this should be in the 'now' section



- **Capture CO₂ from air?**
 - Possible but rather expensive
 - But if we were paid £280/t...????



- **Within the next 10-15 years**
 - Heated by biomass or biogas
 - Electricity from a fuel cell (CHP of course)
 - CO₂ from the heat source



- **In the past (present?)**
 - Build greenhouses next to a heat source
- **Would this be better?**
 - Build greenhouses next to a CO₂ source
 - Build energy projects next to existing greenhouses
 - Build other energy users (especially electricity) next to greenhouses



- **Lots of questions and challenges**
- **Plenty of technical solutions**
 - Not yet commercially proven
 - Far from commercially viable
- **Protected horticulture could be part of the solution to so many things**
 - With the right support, policies & incentives the opportunities could become reality





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Thank you

