TAY CITIES
CLEAN GROWTH

Be part of the transformation

The home of clean growth in Scotland's Tay Cities region

Clean energy & Green Agri-tech event
26th September 2023

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TAY CITIES
CLEAN GROWTH

Iain Stirling

Owner – Arbikie Distillery

Welcome

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TAY CITIES
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Cllr. Beth Whiteside

Council Leader – Angus Council

Welcome

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TAY CITIES
CLEAN GROWTH

David Linsley-Hood

Locogen Consulting Ltd

Locogen

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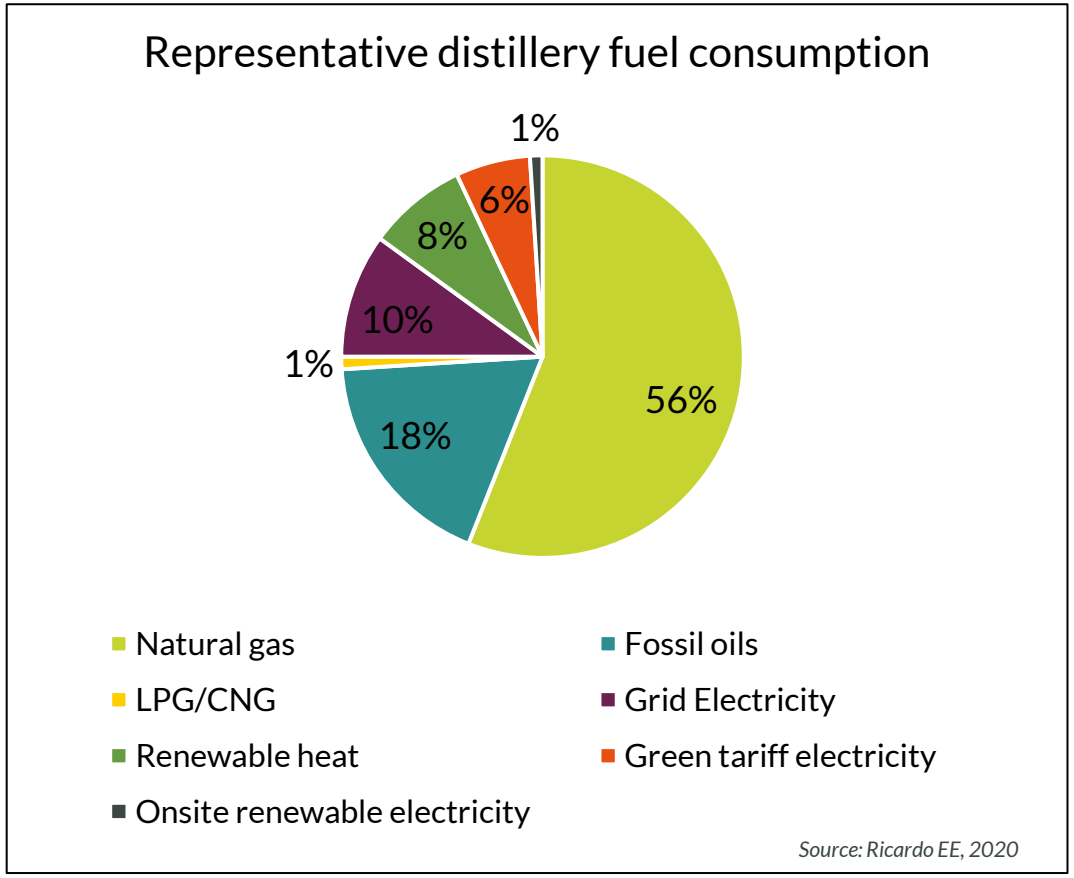
Wind Turbine
Green hydrogen
powered distillery

NET ZERO EMISSIONS BY 2050

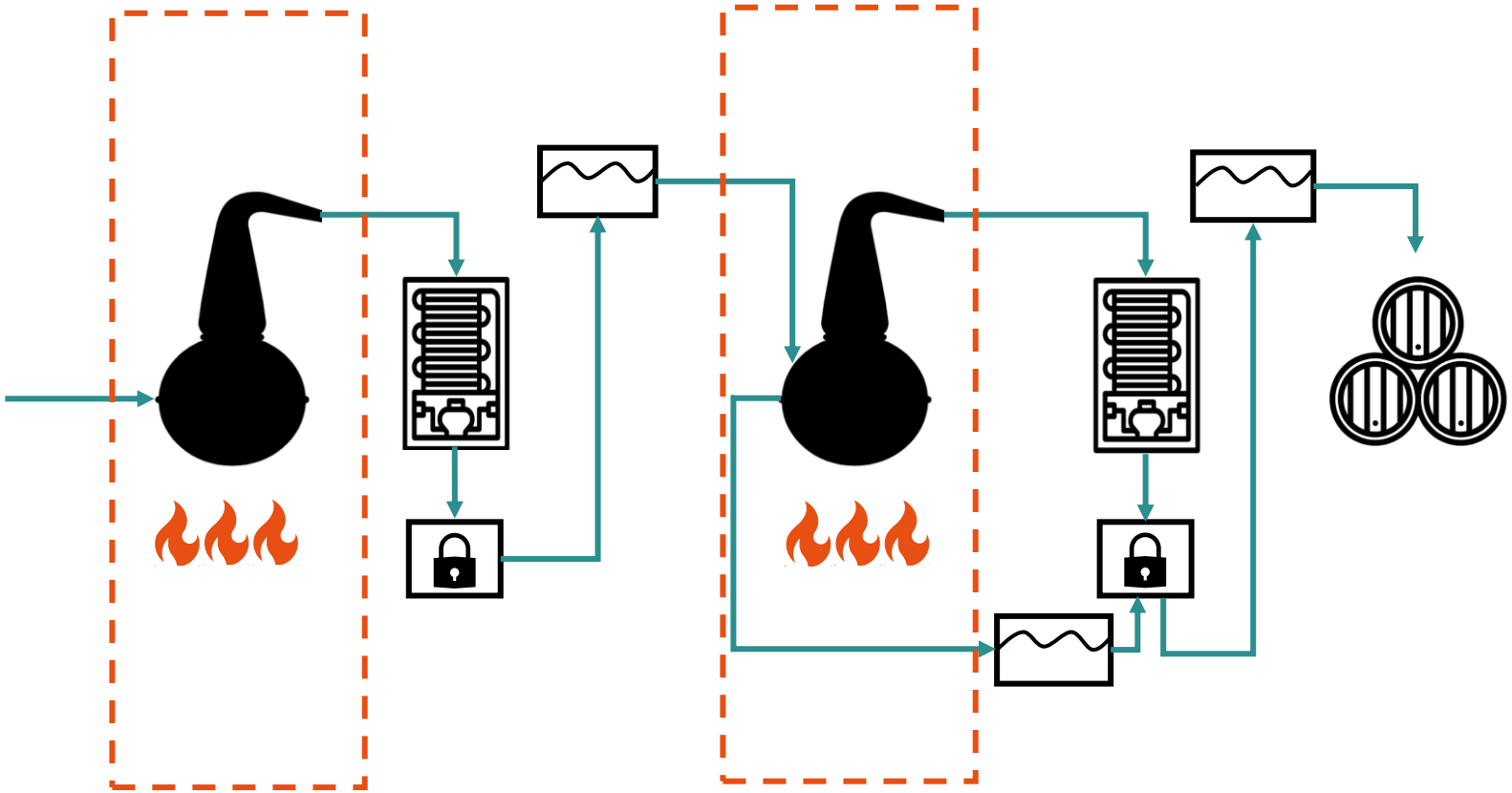
"To be net zero, an organisation must be reducing its emissions along a 1.5°C trajectory across Scopes 1, 2 & 3"
Carbon Trust*

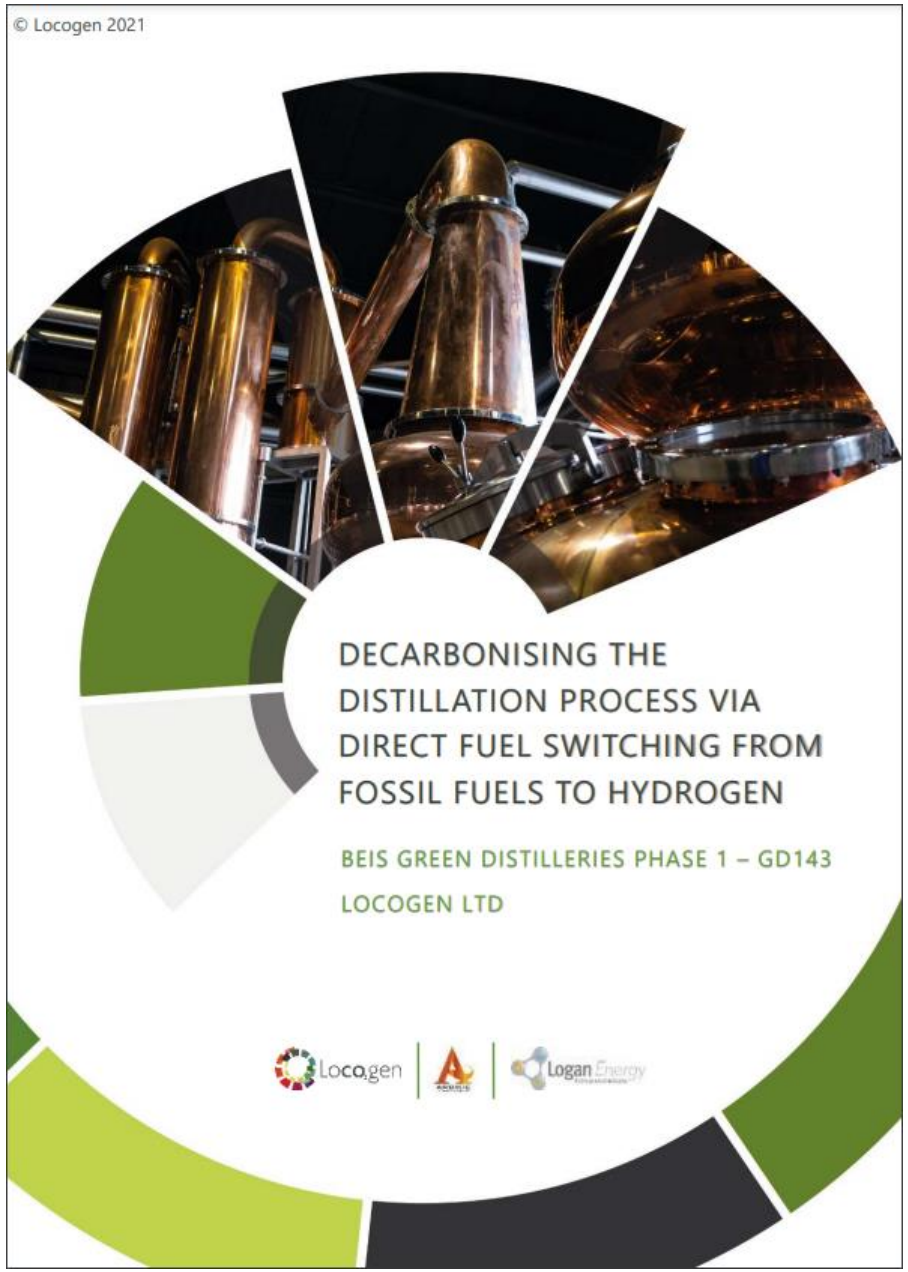
*"Generating heat for distillation is the primary source of emissions and the key technical challenge"***

*https://www.carbontrust.com/what-we-do/assurance-and-certification/carbon-neutral-certification
**https://www.scotch-whisky.org.uk/media/1733/scotch-whisky-net-zero-report.pdf



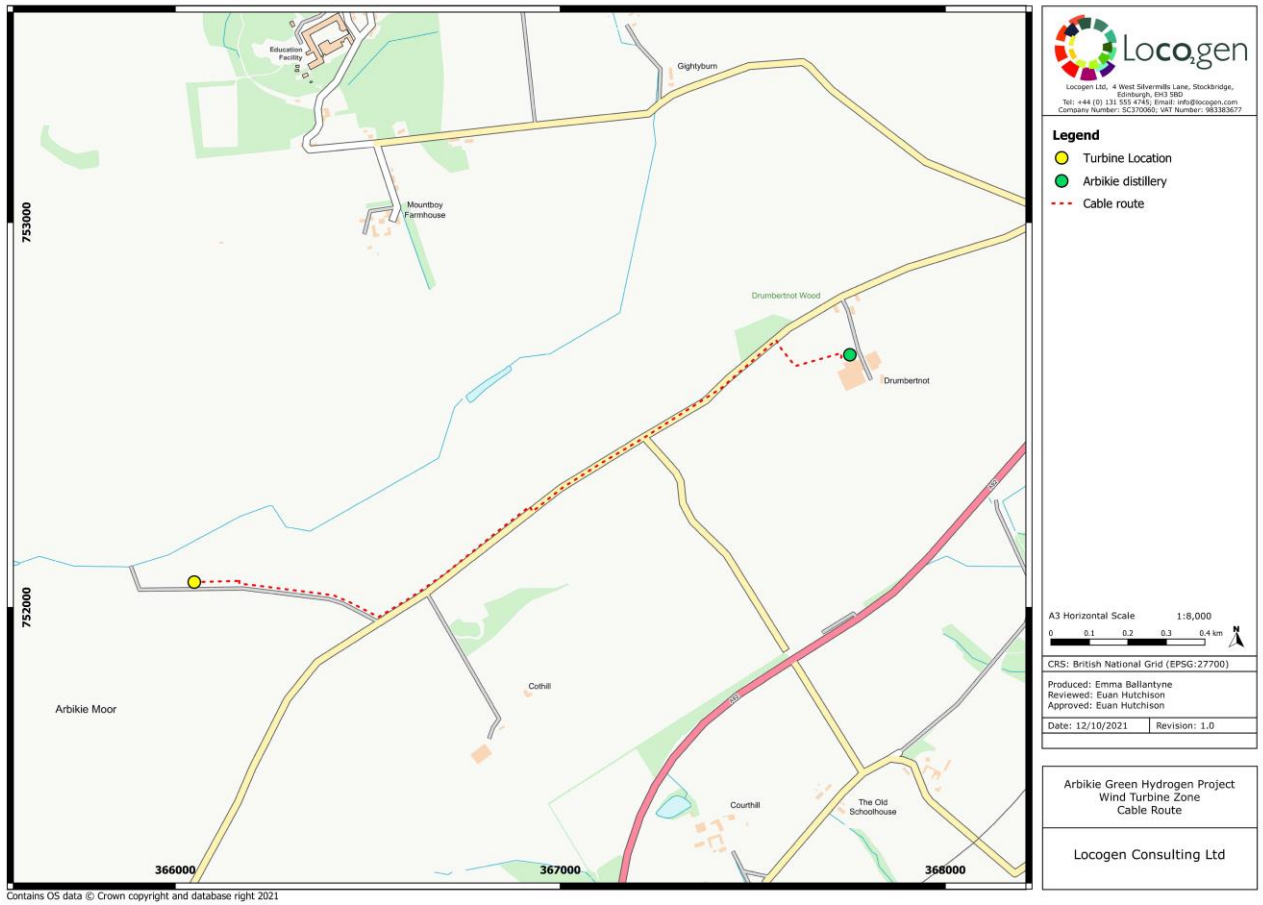
DISTILLING ACCOUNTS FOR >75% OF ENERGY USAGE




© Locogen 2021
DECARBONISING THE DISTILLATION PROCESS VIA DIRECT FUEL SWITCHING FROM FOSSIL FUELS TO HYDROGEN
BEIS GREEN DISTILLERIES PHASE 1 – GD143
LOCOGEN LTD
Locogen
Logan Energy

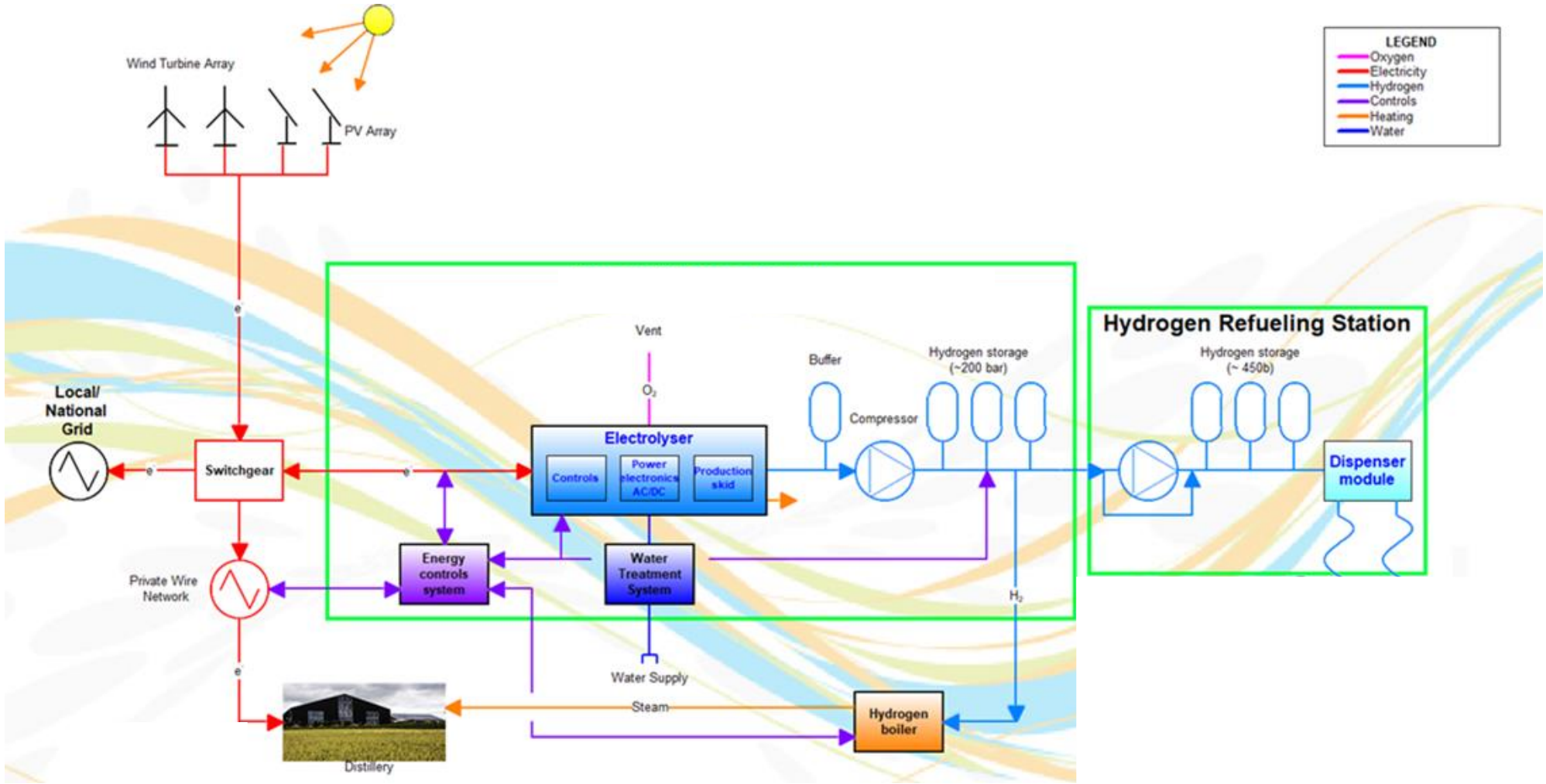
Loco2gen

PROJECT OVERVIEW

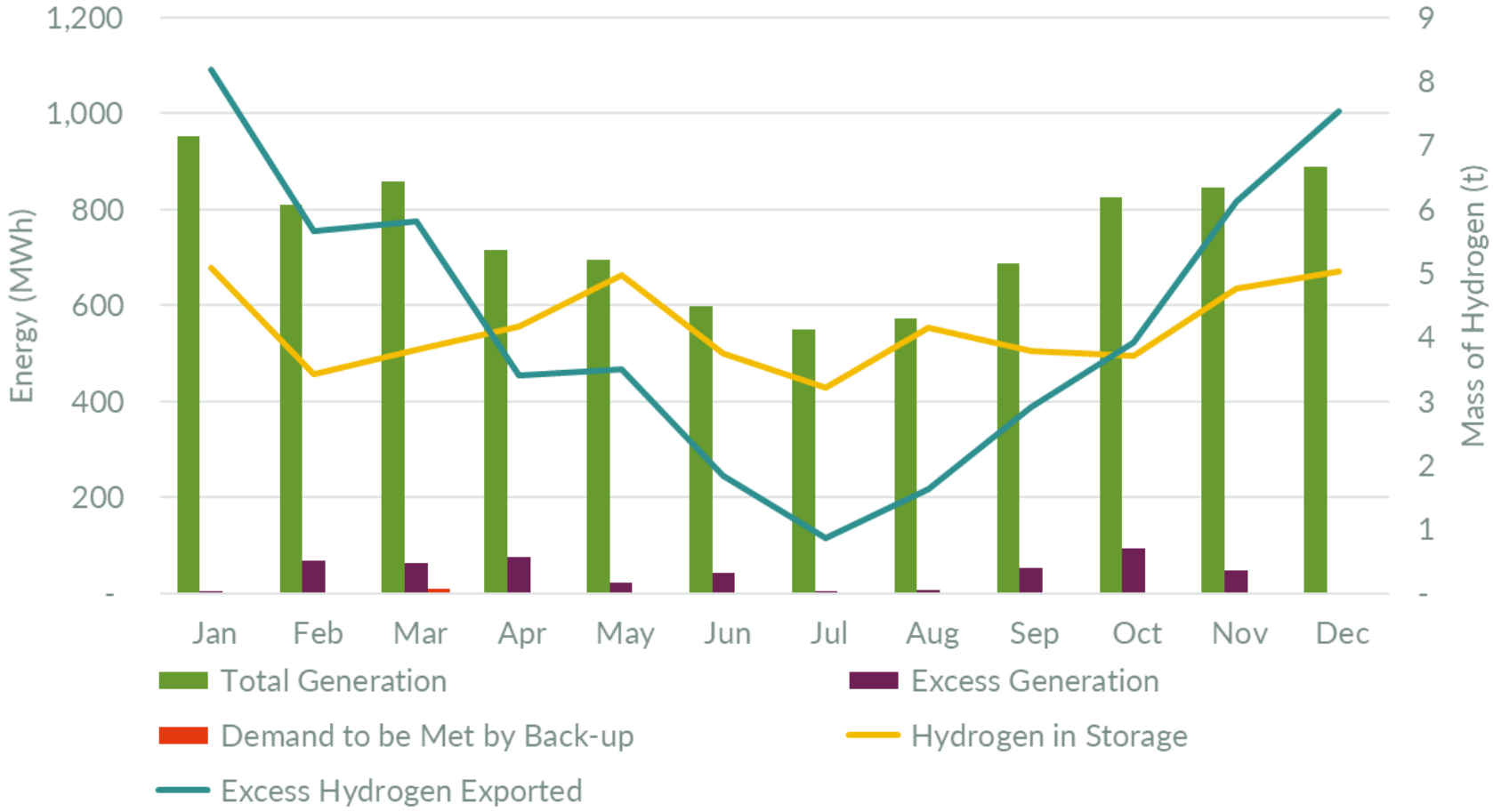


- Arbikie Distillery uses 300,000 litres of gas oil per year
- ~2.5 GWh demand
- ~800 tCO_2e/a
- Replace with green hydrogen
- Wind generation with electrolysis
- 1MW wind and electrolyser provide ~50% of demand

Hydrogen infrastructure



ARBIKIE'S NET ZERO JOURNEY



David.hood@locogen.com

Thanks to our project partners and funders:

Department for Business, Energy & Industrial Strategy

ARBIKIE HIGHLAND ESTATE

Logan Energy hydrogen technologies

Thank you

Welcome any questions

TAY CITIES
CLEAN GROWTH

Prof Derek Stewart

The James Hutton Institute

Director of Advanced Plant Growth Centre

International Barley Hub

Green agri-tech

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ADVANCED PLANT GROWTH CENTRE

Agritech Innovation in the Tay Cites Region

Prof. Derek Stewart
Director of the Advanced Plant Growth Centre
Derek.Stewart@hutton.ac.uk

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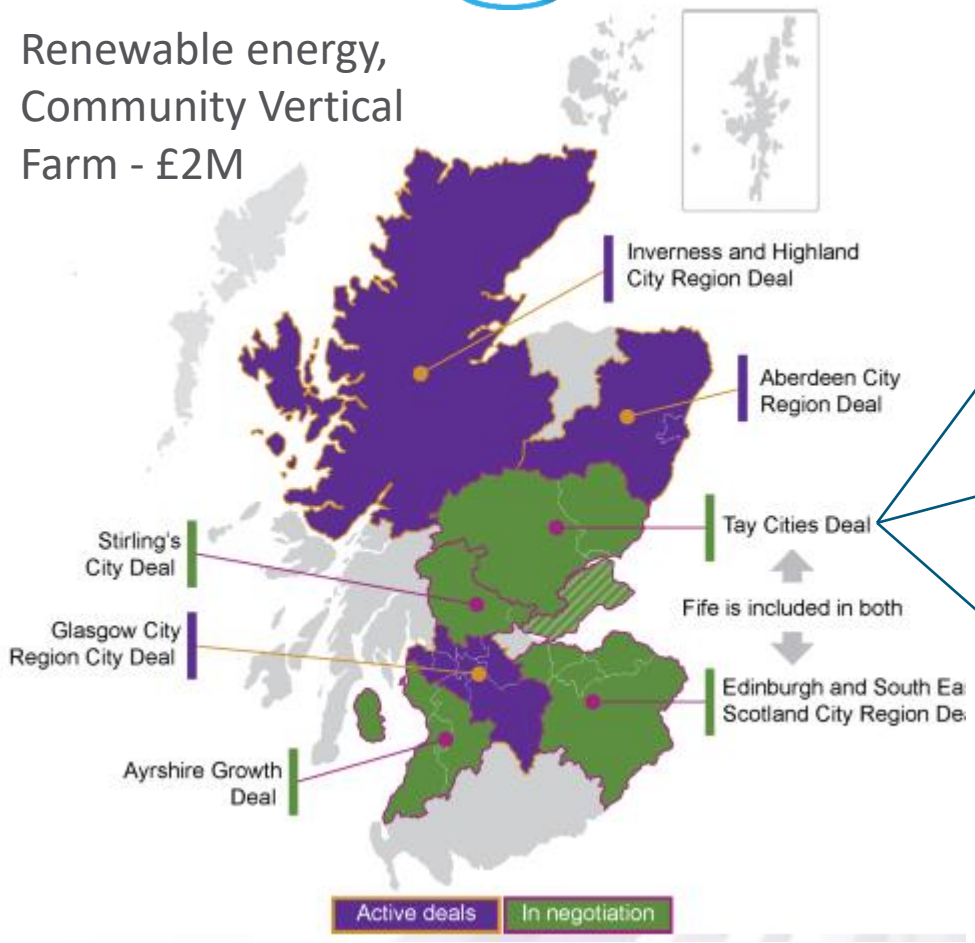
Regional Development Deals

OUR ISLANDS OUR DEAL

Renewable energy, Community Vertical Farm - £2M



ADVANCED PLANT GROWTH CENTRE £27M

INTERNATIONAL BARLEY HUB £35M

CENTRE FOR AGRICULTURAL SUSTAINABLE INNOVATION £?M

www.taycitiescleangrowth.scot

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CLEAN GROWTH

ADVANCED PLANT GROWTH CENTRE

"Deliver increased commercial, economic and environmental benefits to the agricultural, food and drink sectors in the UK and Internationally by innovative use of precision controlled environment technologies."

TAYCITIES Smarter + Fairer

UK Government

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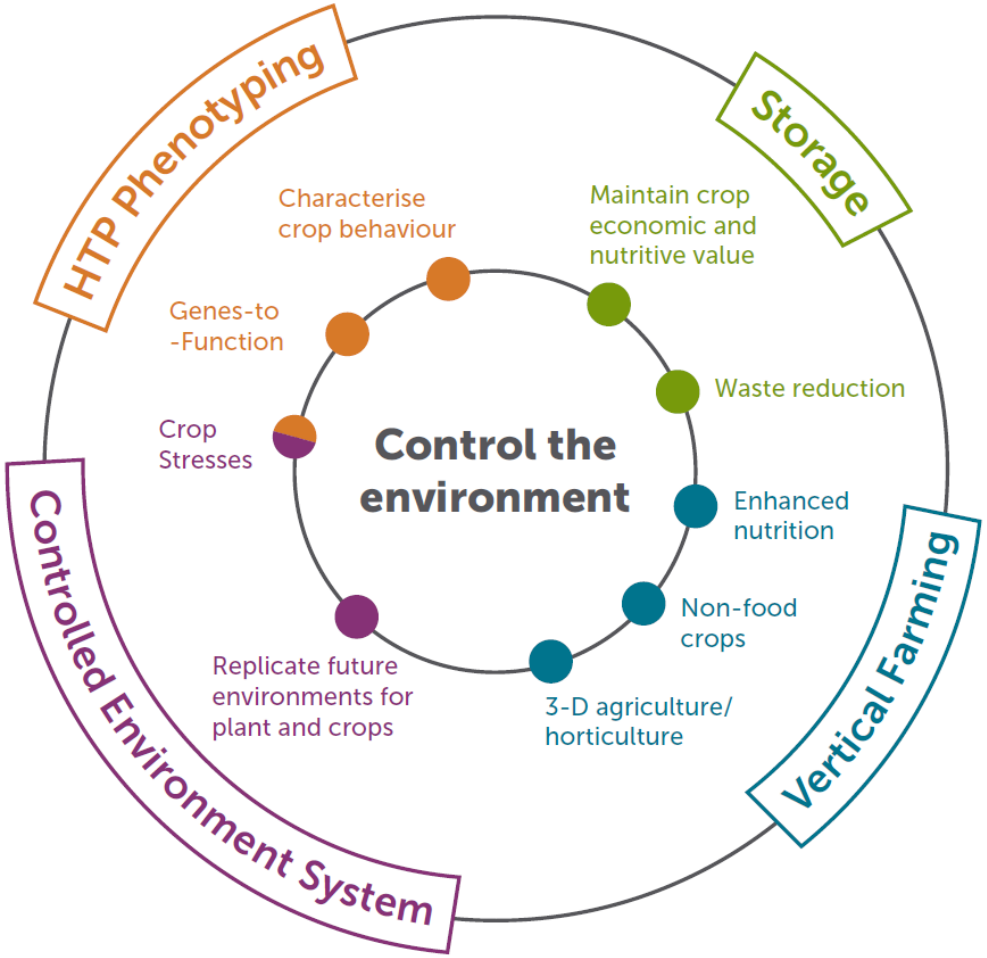
Quadrant model – working together



ADVANCED PLANT GROWTH CENTRE

100 years of breeding – over 200 Plant varieties bred by the James Hutton Institute, its commercial subsidiaries and predecessors

99 Potato

26 Barley

2 oats

26 Brassica,
Turnip & Swede

1 Forage Rape

2 Kale

3 Common bean

1 Salad Rape

4 Lily

27 Blackcurrant

25 Raspberry

Plus the Tayberry and
Tummelberry

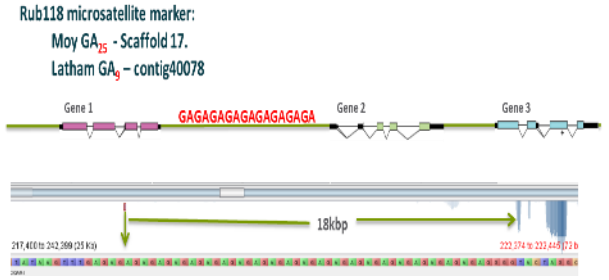
3 Strawberry

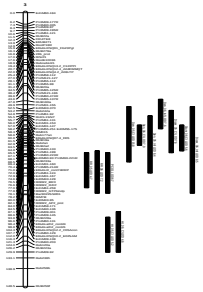
3 Blackberry

1 Gooseberry

Development of phytophthora resistant Glen Mor using Marker Assisted Selection

ADVANCED PLANT GROWTH CENTRE



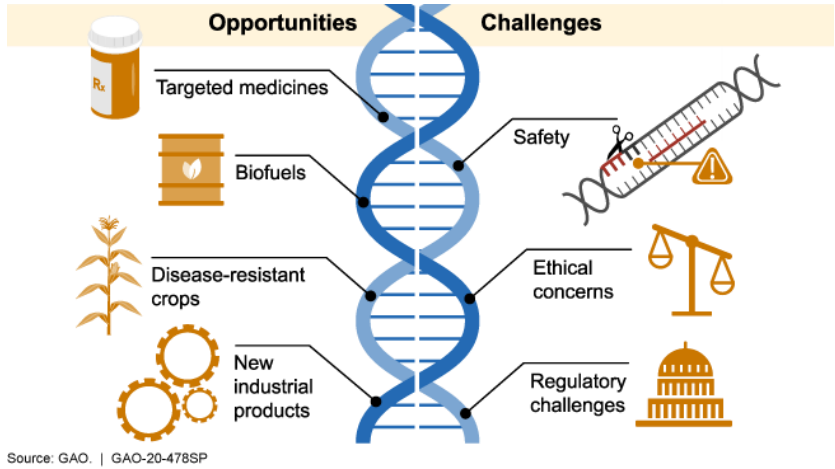


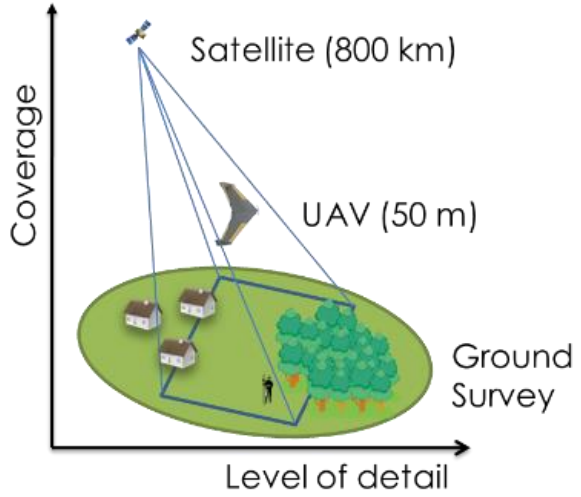
Glen Mor

Innovations in Agriculture

ADVANCED PLANT GROWTH CENTRE

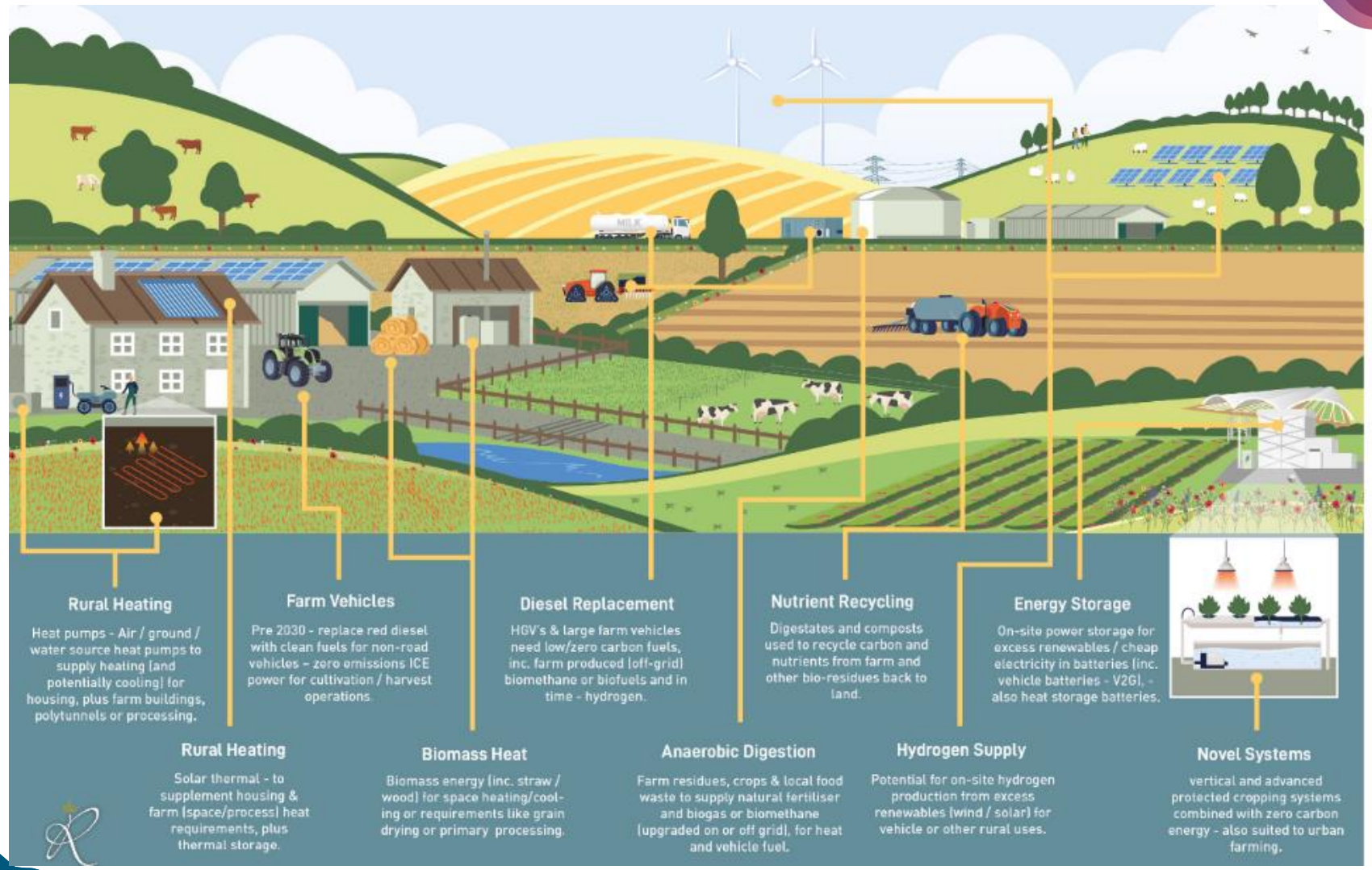
- Livestock
  - Productivity
  - GHG reduction
  - Nutrition
  - Disease/Waste
- Crops
  - Abiotic and biotics stress resistance and plasticity
  - New (old) crops, e.g., proteins crops
- Systems
  - Sustainable and regenerative agriculture
  - Microbiome (plants animals and soil)
  - Digital Agriculture and multiformat data
  - The rise of CEA/VF
  - GM and GE: a new dawn?





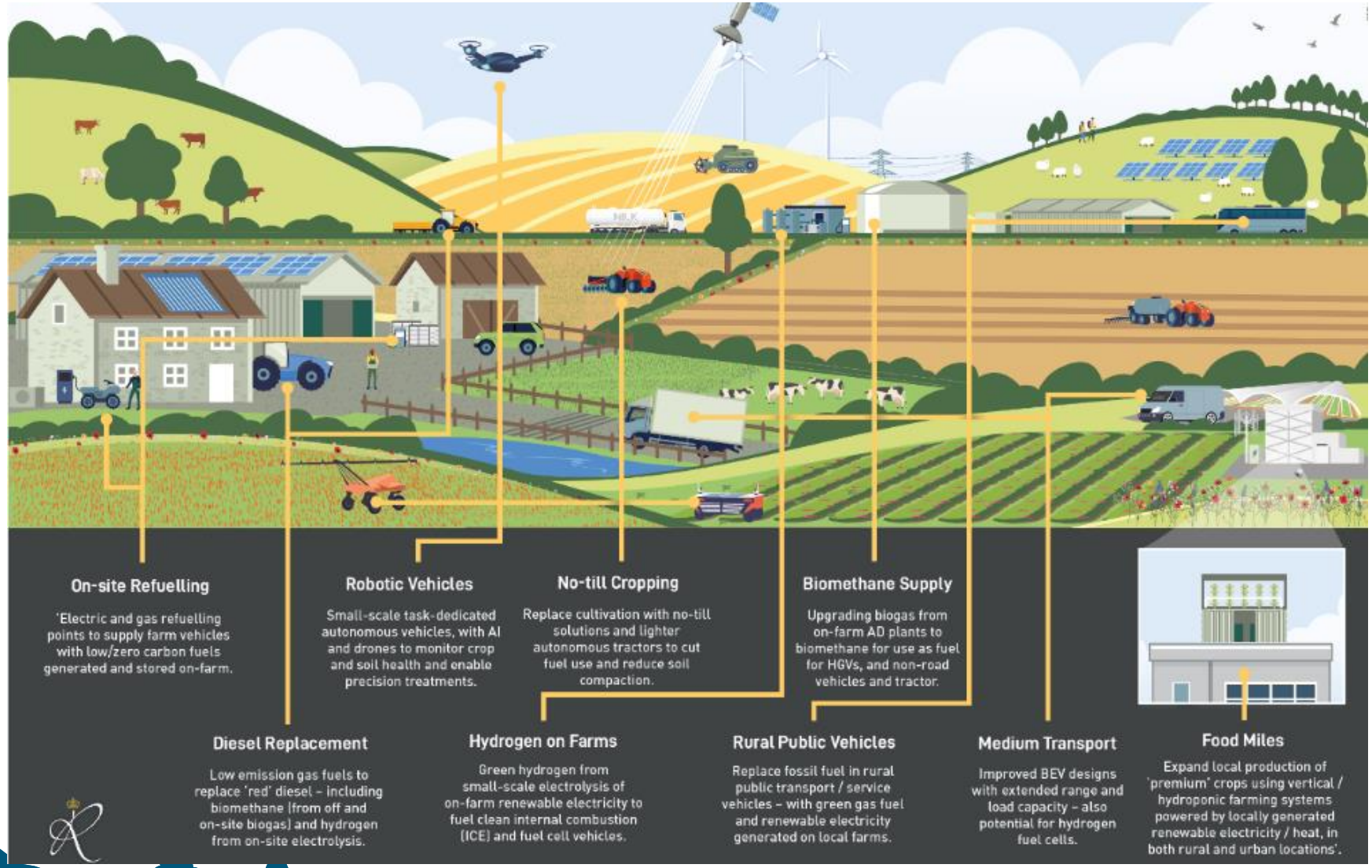
The Evolving Agritech System

ADVANCED PLANT GROWTH CENTRE

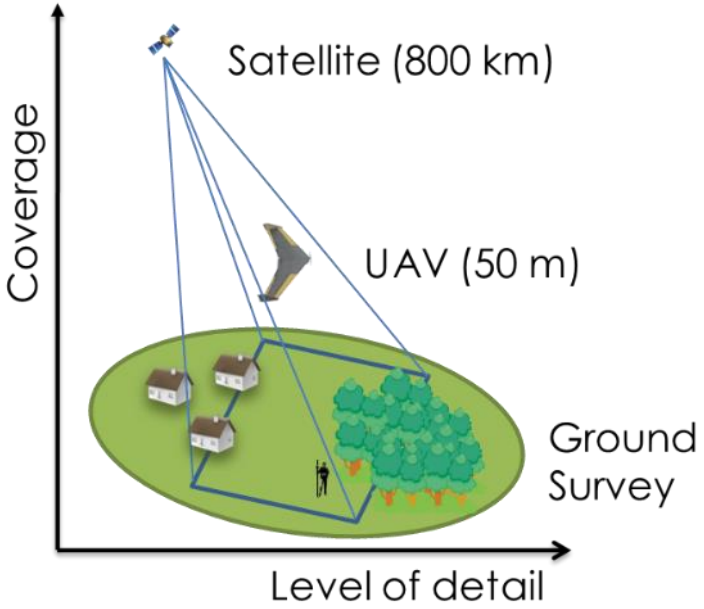


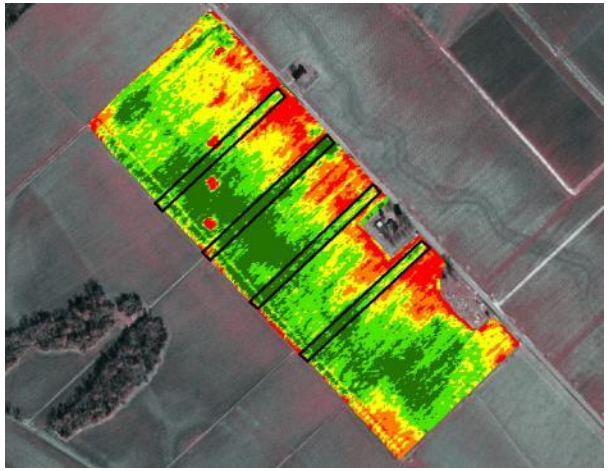
The Evolving Agritech System

ADVANCED PLANT GROWTH CENTRE



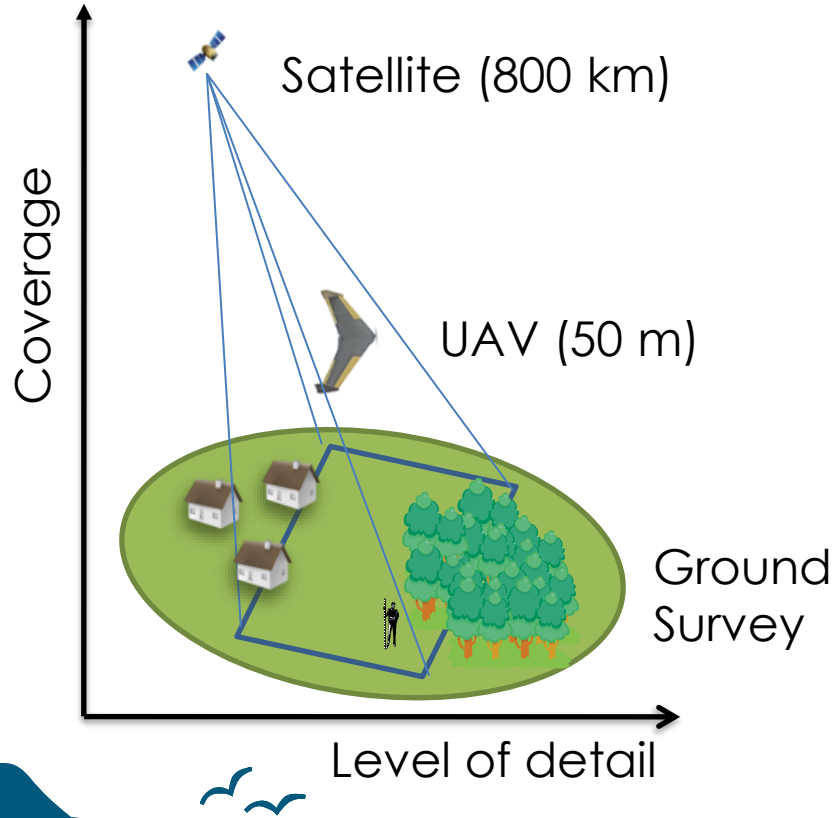
AgriTech and Production

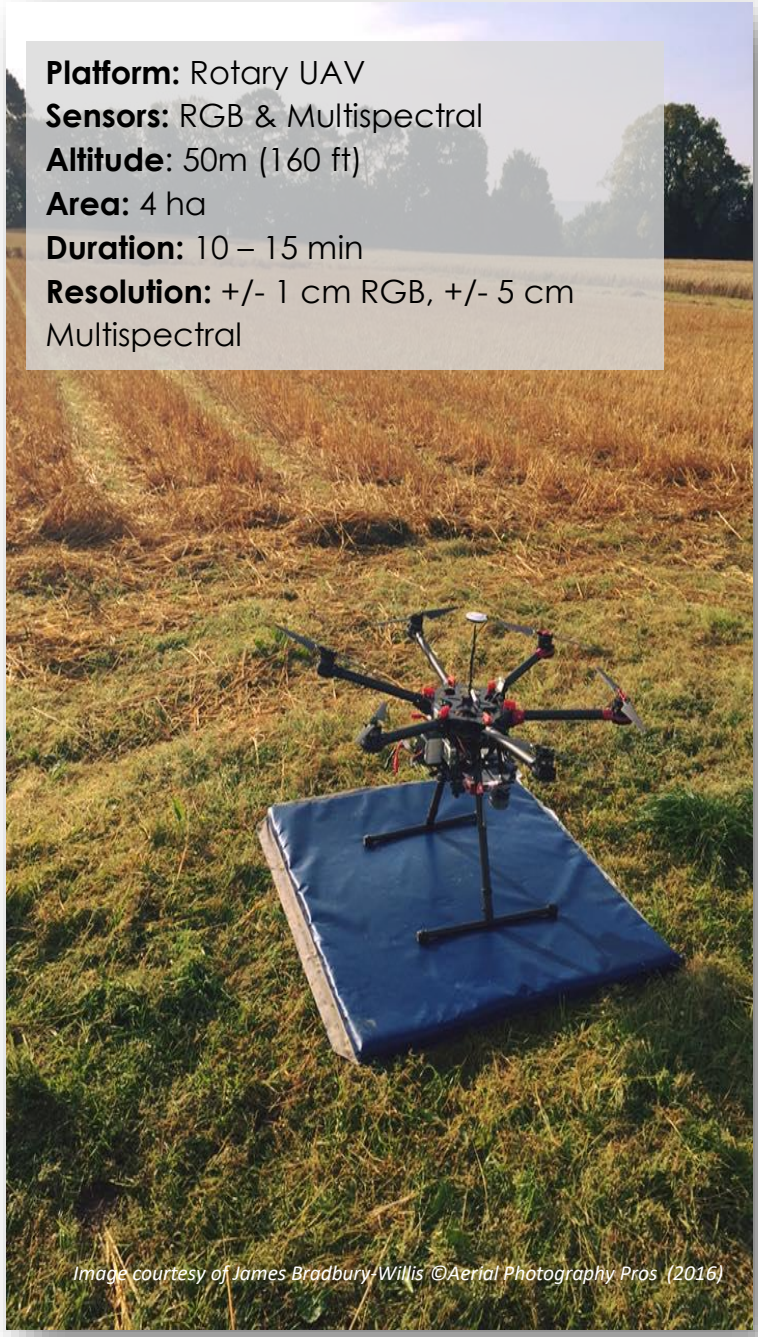




Opti-Oat Remote Sensing

Year 1 and 2 remote sensing data captured from UAV to achieve high spatial detail. Year 3 will also explore satellite for wider area coverage at lower spatial detail

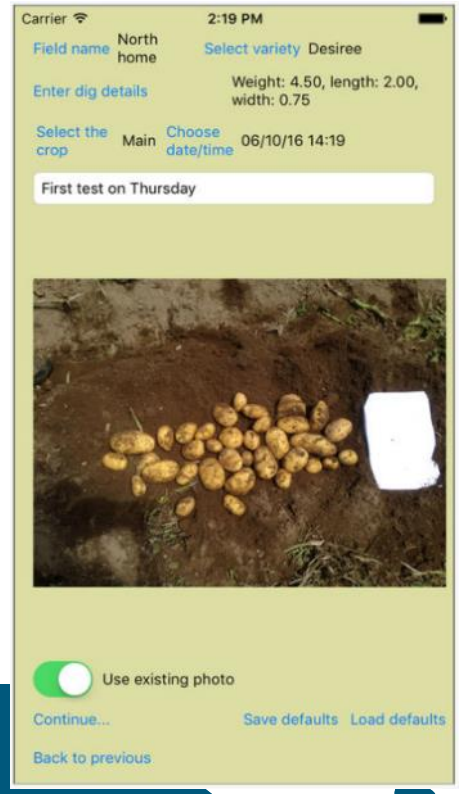


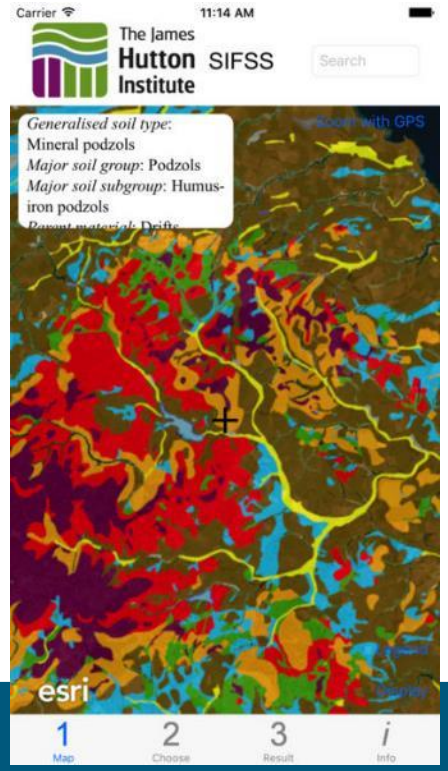


ADVANCED PLANT GROWTH CENTRE

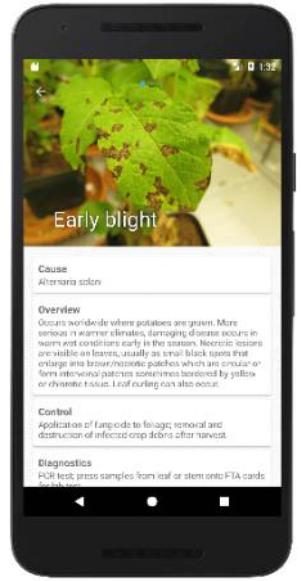
AgriTech and Production

ADVANCED PLANT GROWTH CENTRE



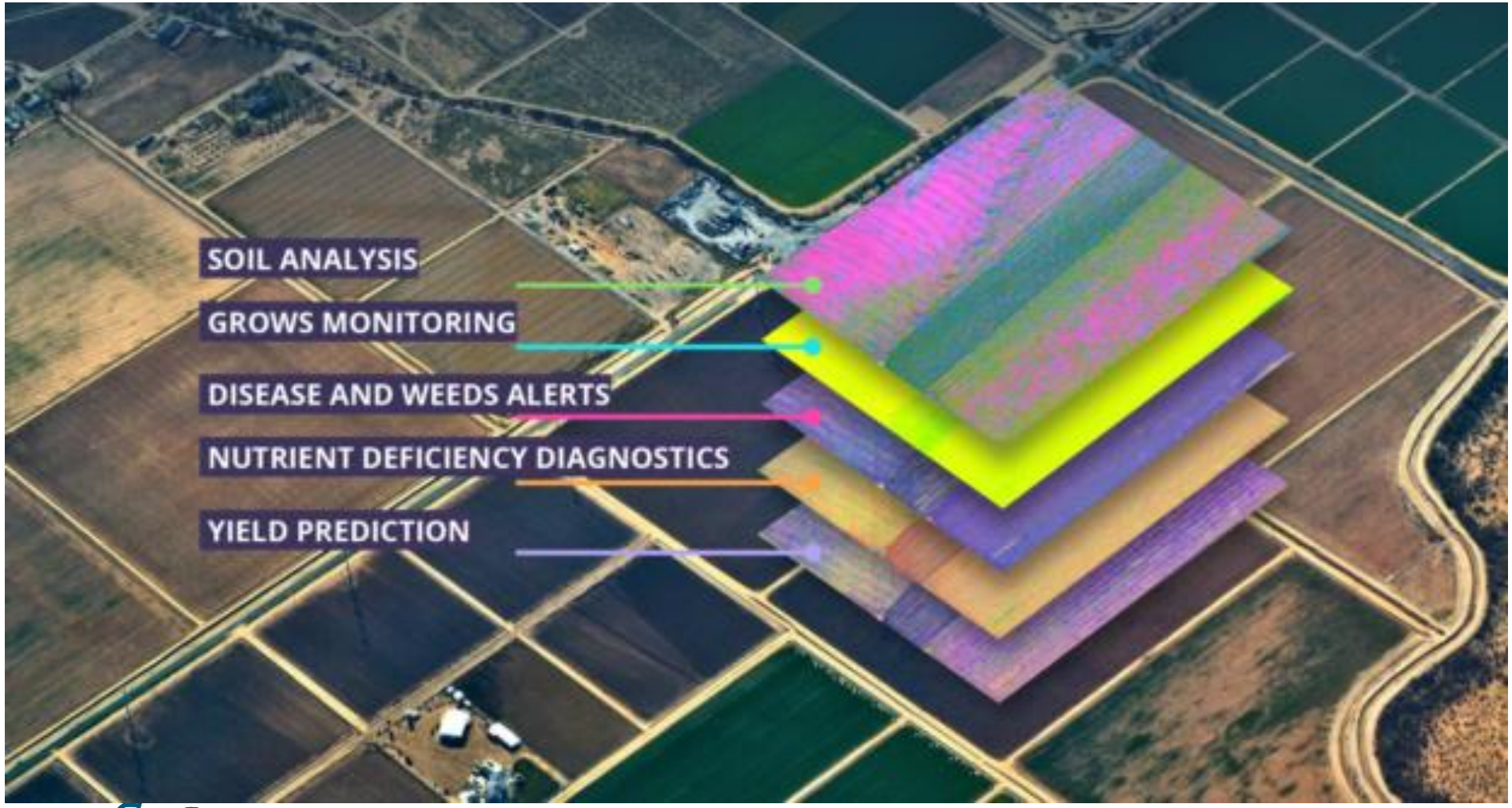


Buntata

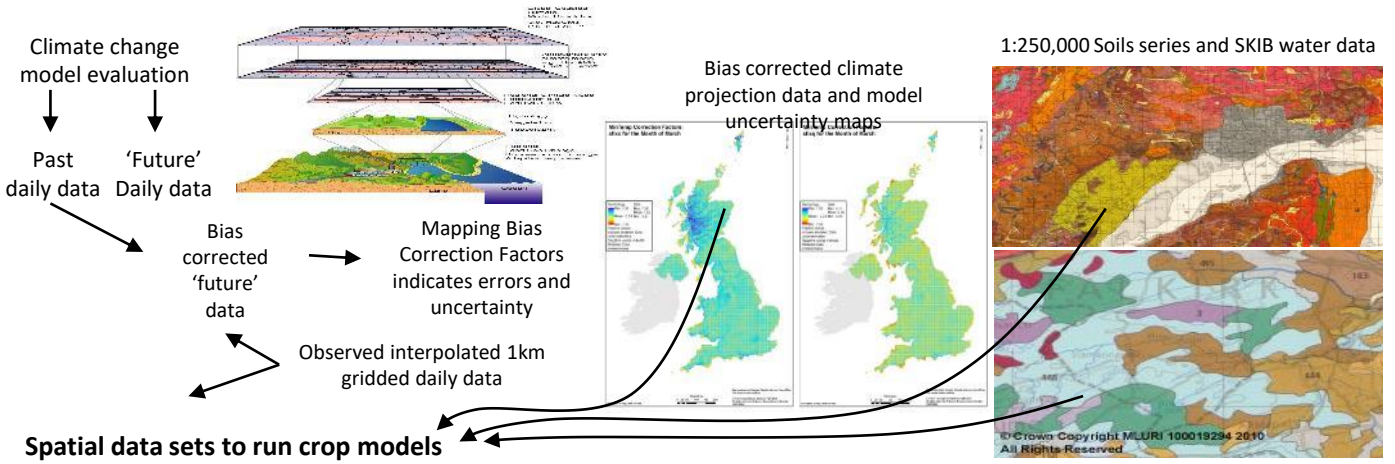


Crop Monitoring using Satellite Imagery

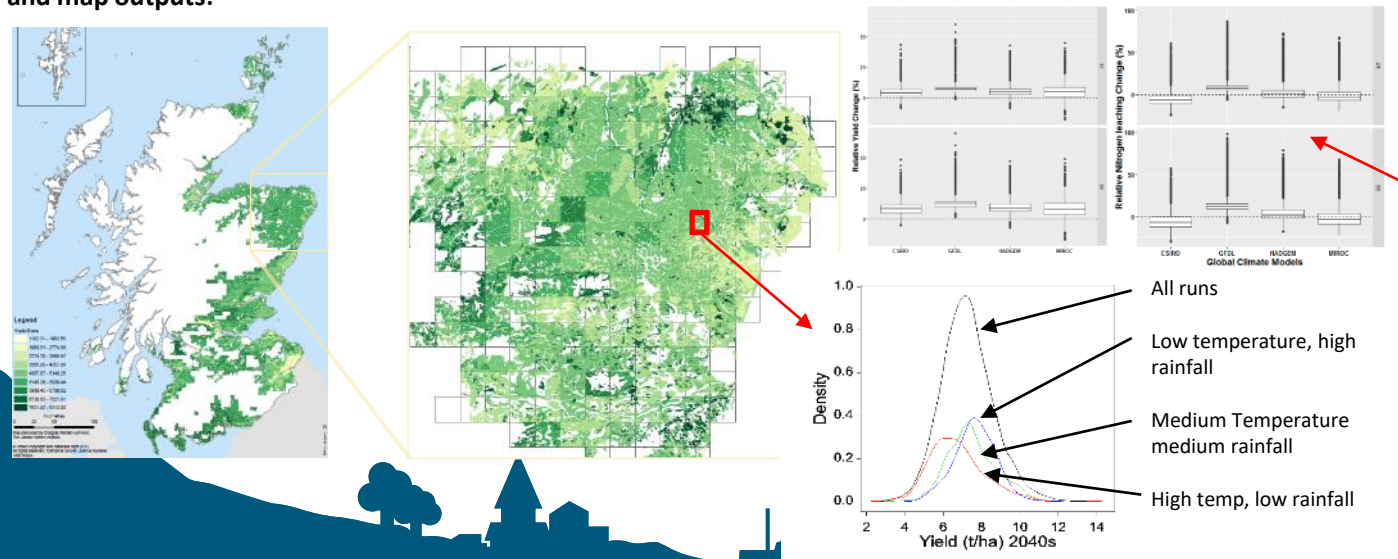
ADVANCED PLANT GROWTH CENTRE



Spatial Crop Modelling: Barley



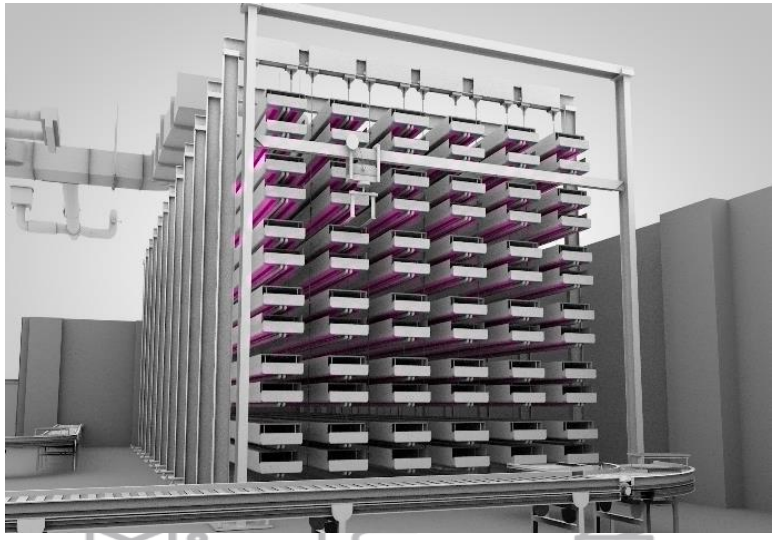
Spatial data sets to run crop models and map outputs:



Integrated modelling framework to combine data sets at different spatial scales and use as input into a spatially applied crop model (DSSAT) at a 1km resolution = **57,209 unique soil-weather combinations** for arable area of Scotland

Estimates made by the model (yield, water and N use, phenology, soil water balance and many more) available on a daily basis for every unique soil-weather combination

APGC – Core Facilities



Vertical Growing

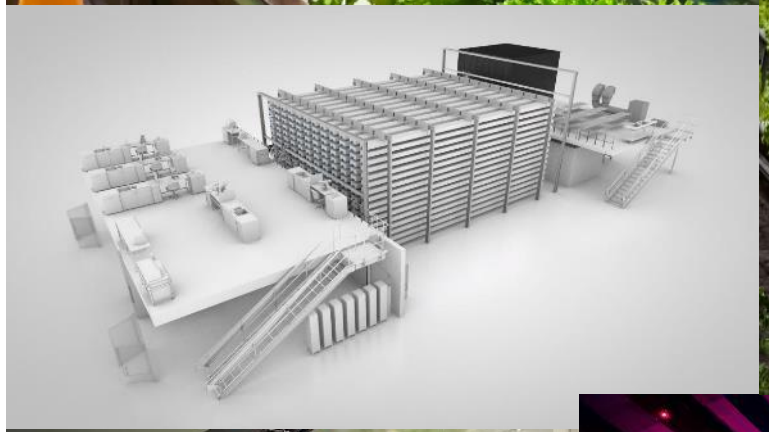
- High throughput growth/phenotyping platform
- Plants grown on multiple trays under LED lighting
- Fully independent control of RGB (+UV)
- Controlled temperature, humidity, mineral nutrition
- Allows for growth of thousands of plants on a tiny footprint (8 m^2)
- Optimised growing environment to accelerate year-round plant growth

Applications

- Crop propagation (e.g. strawberry; native species)
- Optimised production of crops with consistent quality (e.g. baby leaf salads)
- Speed breeding (multiple rounds of progeny selection each year)
- Improved crop functionality
- Pharmaceuticals

Controlled Environment Agriculture/Vertical Farming Food Production 2.0

The James Hutton Institute

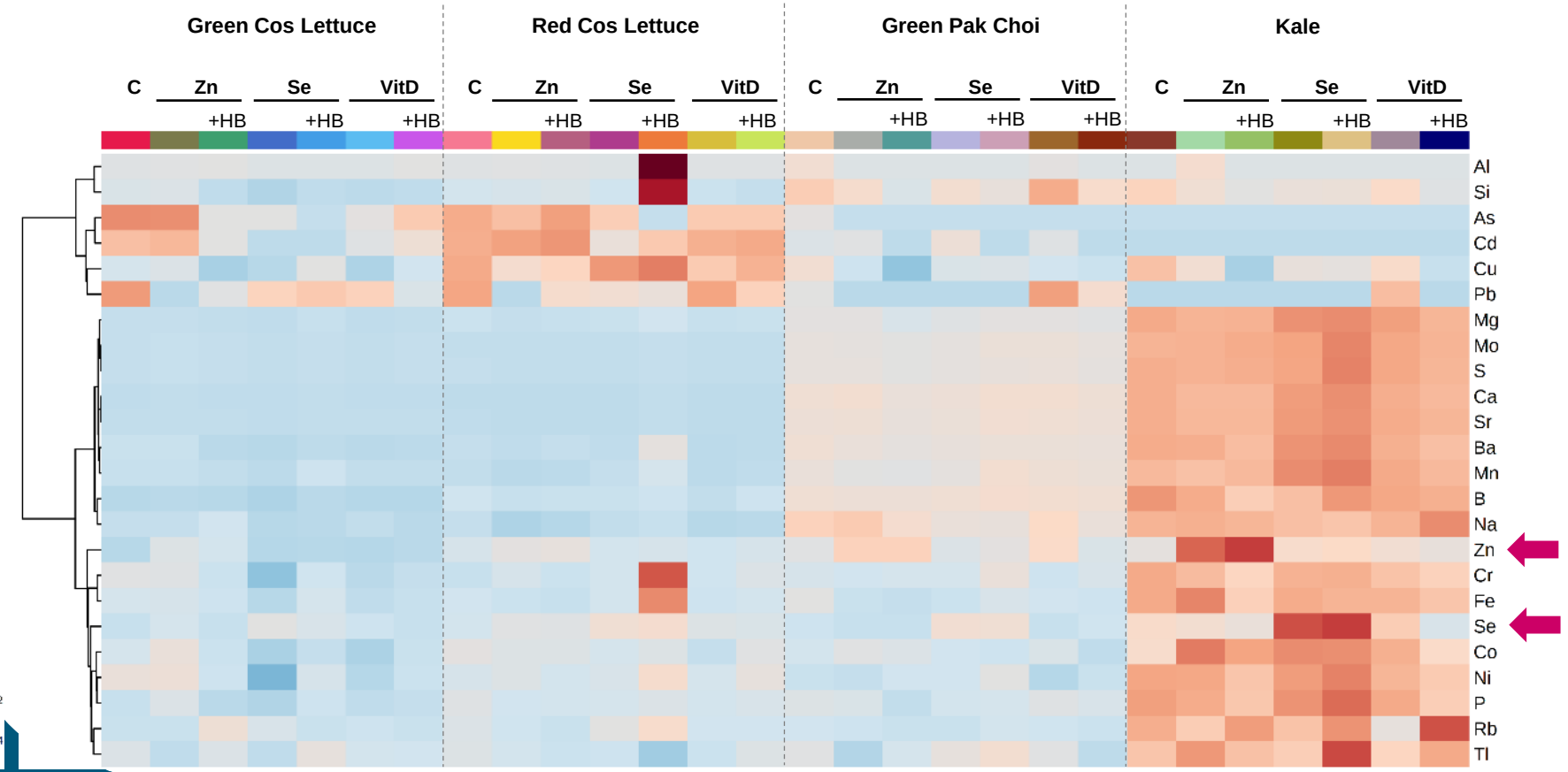


Dosing experiment: Impact on mineral content

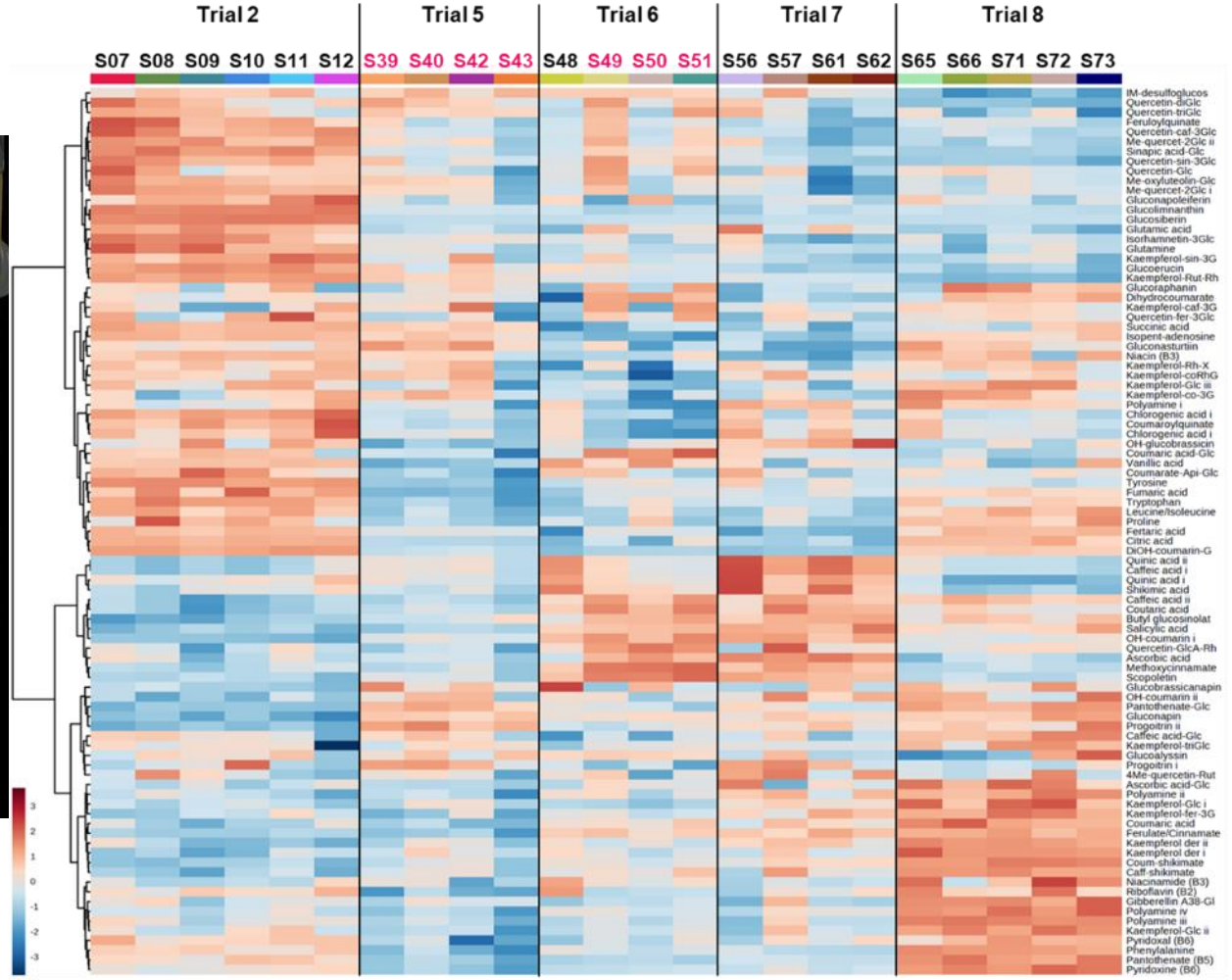
ADVANCED PLANT GROWTH CENTRE

C = control
HB = hydrobubbles
VitD = vitamin D2

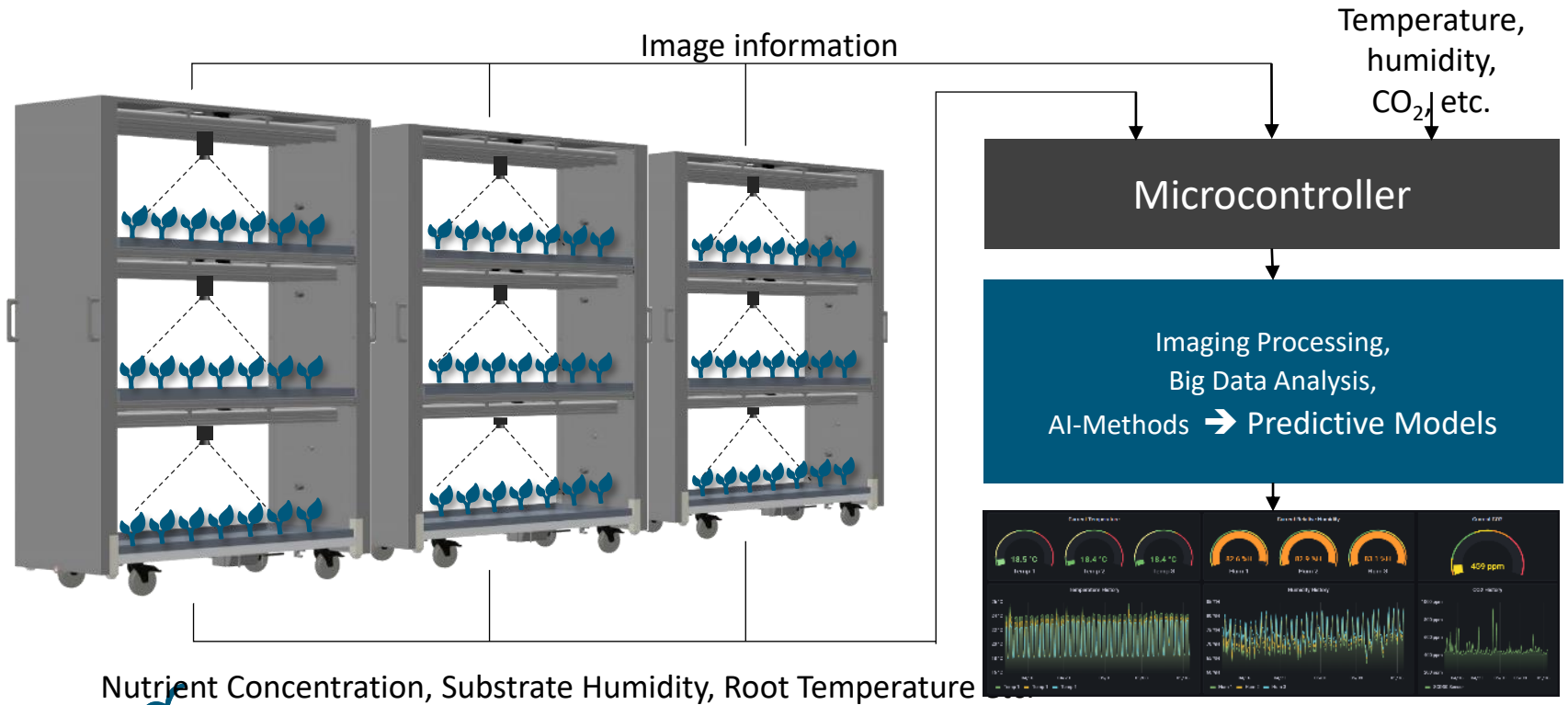
Heatmap auto-scaled by feature (mineral content to be compared across samples only)



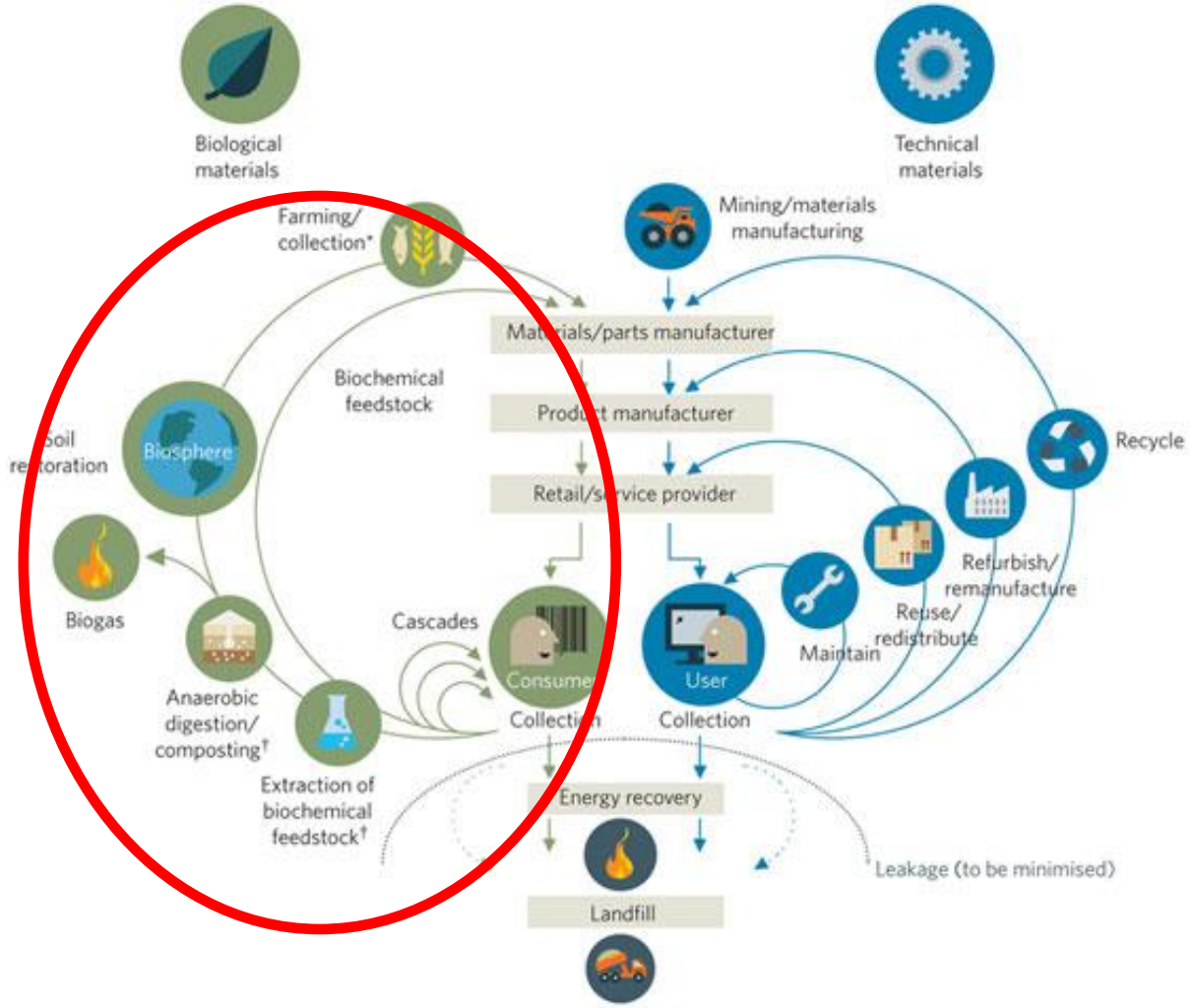
Sensor development



Internet of Plants (IoP)



The Circular BioEconomy



Crop co-products valorisation

Dry

Mill

Stabilised Feedstock

Solvent or CO_2

Extraction (**IB?**)

β-carotene etc

Residue

Process for optimum insect digestion (**IB?**)

Insect feed

Insect production (**IB**)

Dry

Mill

Animal feed

Protein & Oil

Biorefining

Frass (fertiliser)

Thank you

Welcome any questions

TAY CITIES
CLEAN GROWTH

Prof Rob Brooker

The James Hutton Institute

Head of Ecological Sciences

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Agri innovation
CO_2 reduction
Commercialisation

Plant Ecology & ”Soft Agri-tech”

Ecology – the study of the interactions between organisms, and between organisms and their environment

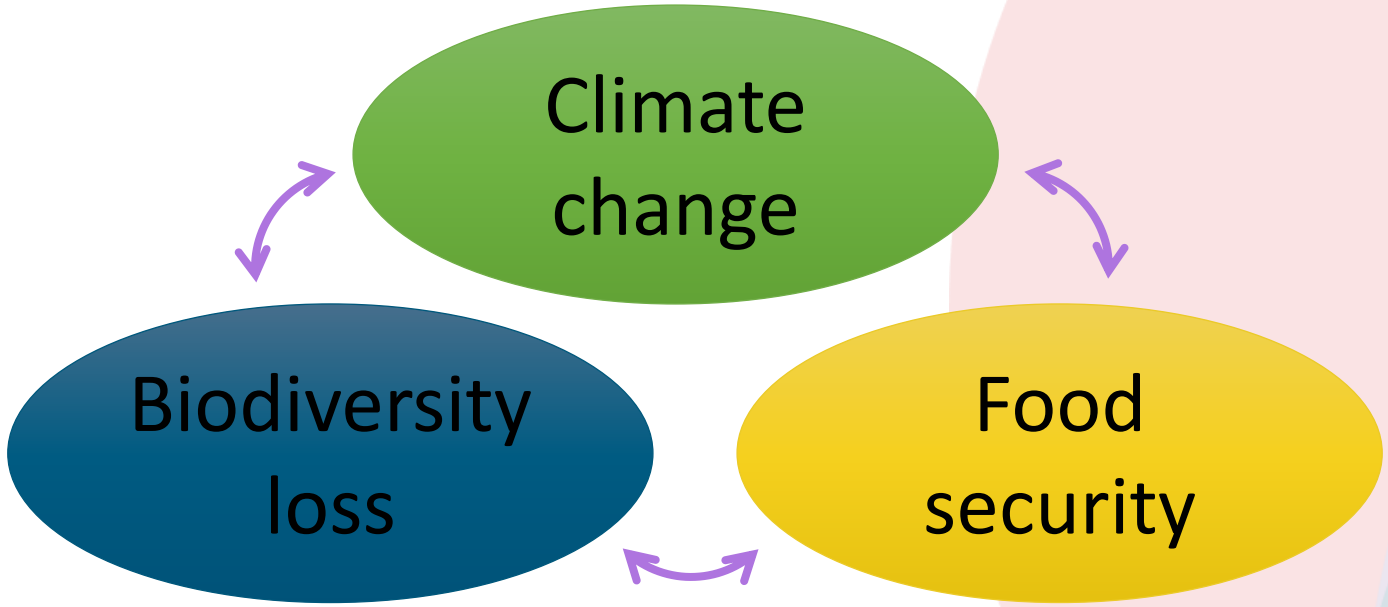
How can plant ecology deliver green agri-tech?

- Agri-tech: the **application of technology** to produce more food with less inputs
- Technology: the **application of knowledge** for achieving practical goals in a reproducible way, as well as the tools that stem from this.

Soft Agri-tech - manipulation of ecosystems for food with reduced inputs and impacts

Win-Win-Wins?

Soft Agri-tech & Win-win-wins



Ideal solutions tackle all three simultaneously

Soft agri-tech - combining ecology, crop science, plant breeding to move beyond a “zero sum game” approach

Nàdar pea-based spirits

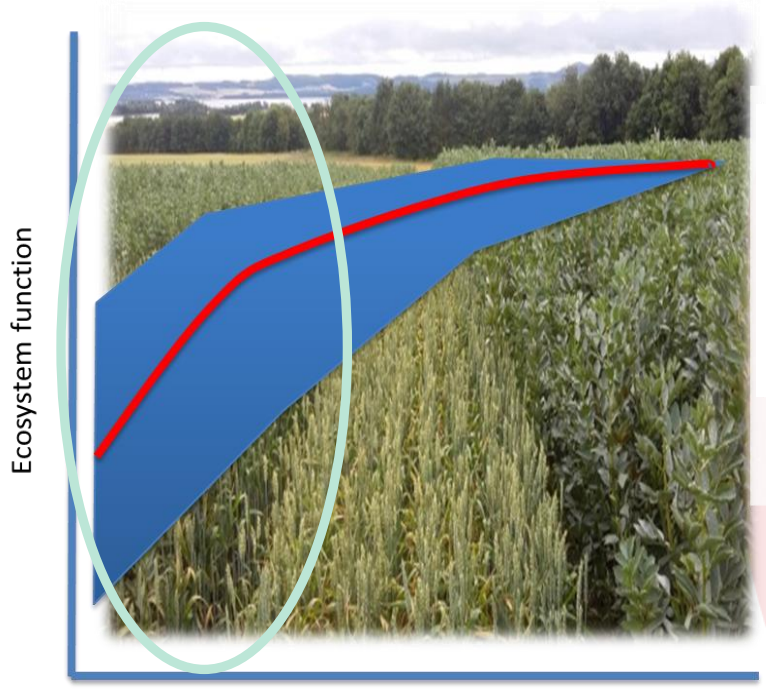
Reduced inputs

- Reduced C emissions from farm machinery
- Reduced run-off (biodiversity and energy benefits)
- Reduced NPK inputs (energy benefits)

Benefits are local and global - global reduced imports of feed protein (use of pot ale)

Developments - older lines of peas with lower protein?

Biodiversity in the mix



Cardinale et al. (2012)
Nature

Increase biodiversity in crop system

↓

Increase ecosystem functions

↓

Increase ecosystem services

↓

Win-win-wins?

Intercrops

- Two or more crop species (or genotypes) **growing together and coexisting**
- Common for unmechanised subsistence agriculture
- Often low input

Biodiversity in the mix

Challenges for intercrops

- Optimising for local conditions
- Provision of advice and guidance
- Cultural challenges around acceptability and demand

SEAMS- Develop, promote and implement crop species mixtures as:

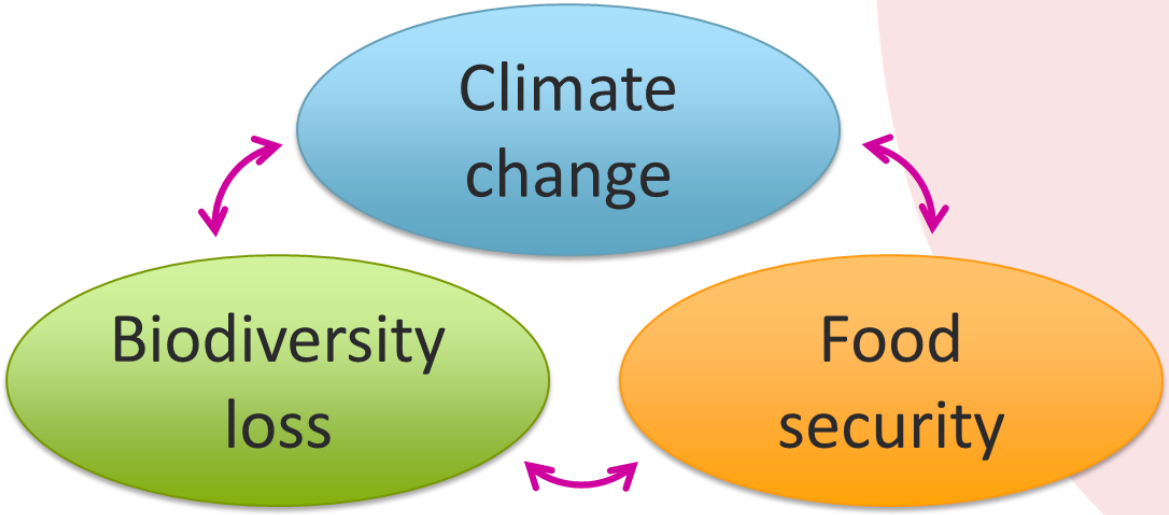
- A sustainable crop production system for Scotland
- A resource for knowledge exchange on food production, agricultural ecology and environmental sustainability to a wider audience including school groups

SEAMS

Esmée Fairbairn FOUNDATION

Biodiversity in the mix

- Enhanced/maintained yields
- Reduced inputs
- Benefits for some components of biodiversity
- Impacts on C balance – more work to do…



It's not just about the biology…

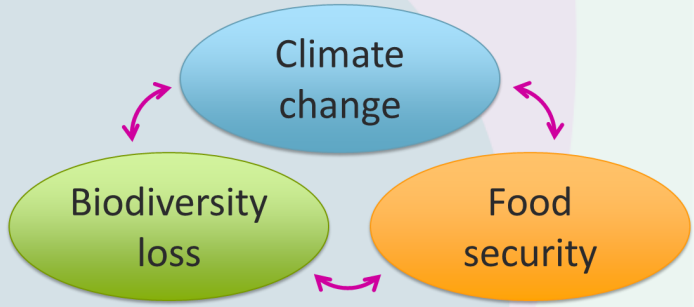
Soft Agri-tech - The road ahead

Targeted action from e.g. crop breeding – what

- Traits for mixtures and novel uses?
- Breeding for resilience and productivity – maybe mixtures are a way out of the dilemma?

Whole systems approach –

- Linking hard and soft agri-tech for sustainable farming systems –
- Options through IBH, APGC, CASI and other initiatives



Thank you

https://arbikie.com/pages/nadar-collection

Crop mixtures:
https://www.hutton.ac.uk/research/projects/seams-sustainability-education-and-agriculture-using-mixtures

https://www.hutton.ac.uk/sites/default/files/files/SEAMS%20final%20report_final%20version.pdf

https://plant-teams.org/#guidestoolboxes

www.taycitiescleangrowth.scot

TAY CITIES
CLEAN GROWTH

Mark Richardson

Ristol Consulting

Clean Growth Initiative member

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Summary
CGI
Tours

Summary

Showcased the **innovation, capabilities and strength** of the Tay Region in delivering transformative change in decarbonising our economy.

Seen **world class projects** that are being delivered in the Tay Region through collaboration and partnership, focused on sharing experiences to support wider application and commercialisation.

This approach will enable us to **building a regional skill set and profile** that can deliver scalable economic, investment and training opportunities.

Benefits of CGI

Builds a regional profile to attract investment and develop skills and career opportunities, as projects evolve.

Strengthens the **opportunity for collaboration and partnership** within the public, private and academic sectors to support the delivery of clean growth projects.

Provides a **platform** of scale and breadth to share experiences and coordinate positive action, signpost funding opportunities and identify research programmes.

Register as a member

Click

TAY CITIES CLEAN GROWTH

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Connect

Collaborate

Tag partners and members on your social media

#

@

Tours

1. Wind to green hydrogen at Arbikie – led by Locogen (David)

2. Green agri-tech – led by James Hutton Institute (Derek)

3. Agri innovation at Arbikie – led by James Hutton Institute (Rob)

Bon apetit!

Please follow the events team
upstairs for the networking lunch.

Please reach out to fellow attendees
to find synergies.

See you at 1pm for the tours