FEASIBILITY STUDY INTO THE PROVISION OF GREEN ENERGY BY THE ANAEROBIC DIGESTION PROCESS

Birr 20:20 Vision CLG

global **environmental** and **advisory** solutions

SLR

Introduction

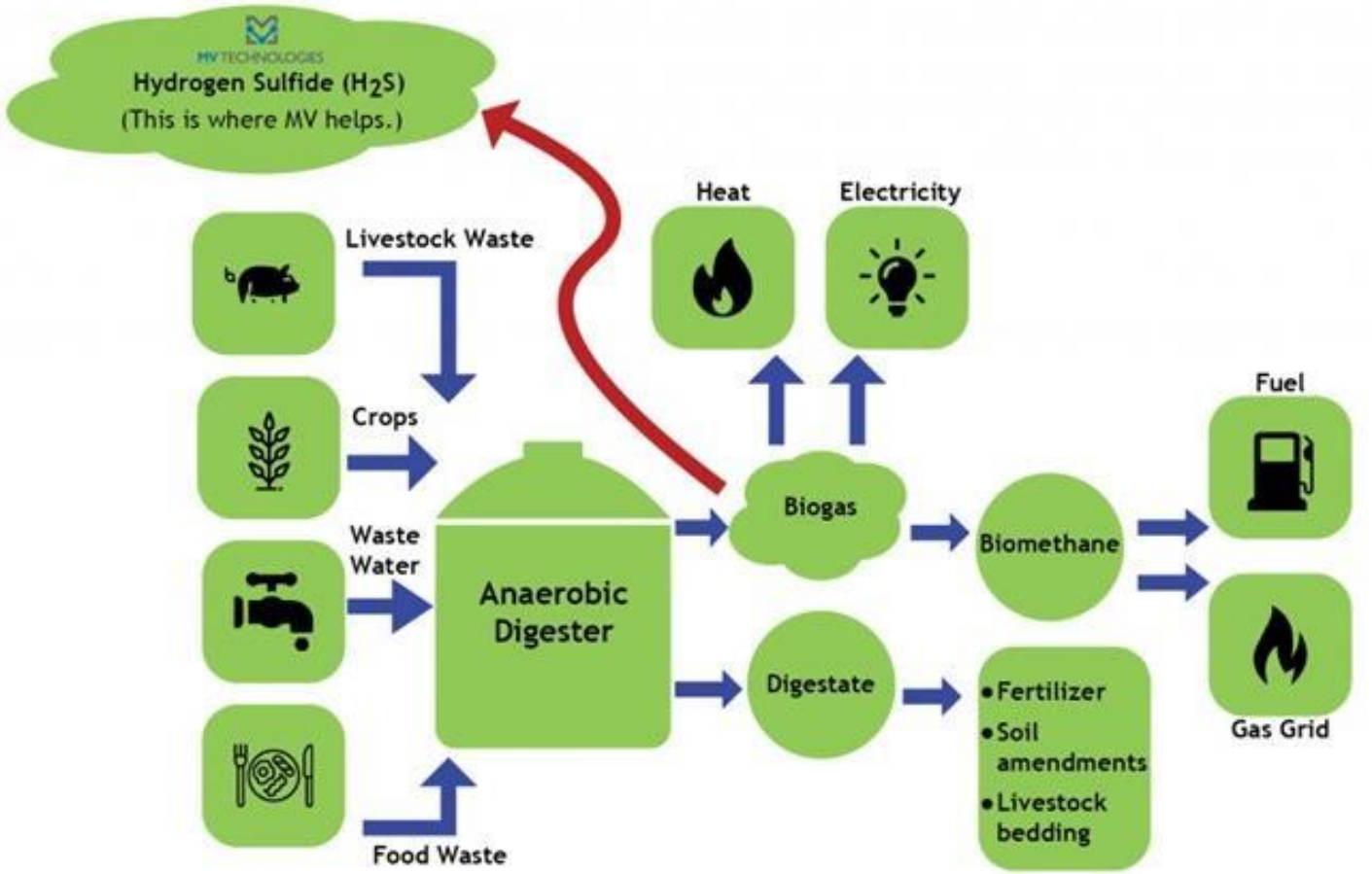
In early 2021, Birr 20:20 Vision CLG commissioned a Feasibility Study into the Provision of Green Energy by the Anaerobic Digestion process to support local generation of bioenergy and potential conversion of waste and biomass feedstocks to energy, in support of the rollout of the Just Transition programme in County Offaly.

The project has two core objectives:

- ✓ Provide an income-earning opportunity for part-time farmers being made redundant by cessation of peat production, as well as other interested farmers, through the growing of bio-energy crops.
- ✓ Re-orientation of energy use from carbon-creating sources to green energy sources in South Offaly.

What is AD?

- Anaerobic digestion (AD) is a process through which bacteria break down organic matter such as manure, crops and food waste in the absence of oxygen to generate a combustible gas, biogas, comprising methane , carbon dioxide, water vapour with some other trace gases



Practical Uses of Biogas

'Anaerobic digestion (AD) technology produces a sustainable form of renewable energy'. The biogas can be converted into renewable electricity for our homes and businesses or it can be upgraded to biomethane for use as a vehicle fuel or for injection directly into the gas network to provide a source of renewable heat.'

Technology	Considerations
CHP	Biogas requires minimal treatment prior to combustion. Typically, corrosive hydrogen sulphide and water vapour will be removed prior to the CHP. Electrical efficiency is typically 38-40%. Heat is also recoverable and used in the digesters or pasteurisation equipment or as a heat source to digestate or biomass dryers. Heat can also be exported to other heat users such as glasshouses.
Gas to grid	To meet quality requirements, biogas must be converted to biomethane through the separation of carbon dioxide and other trace gases and injection of small volumes of propane to increase the calorific value to an acceptable range. A variety of upgrading technologies are available, with membrane separation the most popular choice. Upgrading produces a carbon dioxide rich offgas which can be released directly to atmosphere or further upgraded and compressed as a marketable commodity
Gas to vehicle fuel	Biogas is upgraded in a similar manner to above and then compressed to high pressure before being transported to end users. It is often possible to co-locate the upgrading and fuelling stations.

Infrastructure Considerations

The study sought to establish whether a suitable site was available for the AD plant

Grid connectivity was assessed for both gas and electricity generation. It was concluded that it is not feasible to connect to the gas grid due to constraints in the South Offaly sub-region. The study concluded that an AD plant could connect to the electrical distribution grid operated by ESB Networks, with connectivity available at various sites considered for the AD plant. This underpinned the proposal that the AD facility should operate as a Combined Heat and Power (CHP) plant, producing *heat, carbon dioxide* and *electrical power*, with *digestate* as the end product of the process. Each of these elements has revenue producing potential.

Site Selection: A high-level process was undertaken to identify suitable sites for an Anaerobic Digestion facility, considering, inter alia, land availability, proximity to residences, infrastructural requirements, roads, water, gas and electrical grid connectivity, and environmental sensitivities. Five sites were screened and two preferred sites emerged: the first located on an antecedent brownfield site at **Derrinlough,** close to existing infrastructure, just 12km northeast of Birr

Two potential sites were identified at Derrinlough and Gurteen Agricultural College”

Stakeholder Consultations

Stakeholder Consultations were held with a range of interested parties, with the following observations

- An appropriate Operational model must be commercially focused and structurally robust, that gains the trust of community and farmers.
- Clear preference for the establishment of a Community Energy Co-Operative, with a commercial arm to run the AD plant.
- Farmers are interested to explore growing reeds as feedstock from low productivity lands, but are concerned about cropping, harvesting and seasonality, Costs, pricing, tariffs, profitability of the AD venture must all be worked out with a clear road map for both community and farming participants;
- National government commitments to bioenergy are not being delivered by pricing supports in the RESS auction system and require to be addressed at national level.

The conceptual AD plant would be designed as a combined heat and power (CHP) plant; located at an antecedent industrial site; sell electricity to the distribution grid and preferably co-locate the plant with other industrial / commercial units to generate further economic activity and jobs. Feedstock, sourced largely within a 50km radius, for the plant The 'waste' digestate could potentially be used as a peat replacement for horticulture and/or as a farm manure.

Consultees included relevant statutory agencies, farmers, farming organisations, horticultural industry, Offaly public participation network (PPN), environmental NGOs, community energy, rural development and community activists

Sourcing of Feedstocks

Detailed consideration was given to sources of feedstocks, using publicly available databases, from a range of sources in Offaly and neighbouring counties of Galway, Tipperary, Laois and Kildare.

- No definitive sources of **commercial/ industrial wastes** were identified in the immediate (50km) vicinity that could be used for AD purposes and haulage costs beyond that would likely be prohibitive. Municipal food waste, if available, could be used, but appears to comprise only a small proportion of the total available; it also requires specialist processing equipment to remove contaminants such as plastics and metals.
- **Animal manures** may be used to generate limited quantities of biogas, but has the potential to reduce agricultural greenhouse gas emissions significantly. Significant volumes (e.g. 70,000t of pig slurries) of manures and slurries are available within 75km of Birr and could be expected to play their part in the feedstock 'recipe'
- **Agricultural biomass feedstocks** (oats, maize, barley, wheat etc) are very suited to AD and can be grown in crop rotation, providing a very consistent and high gas yielding feedstock. They need little pre-treatment, and if harvested at 27-40% dry matter (DM, suited to ensiling) and chopped finely at the point of harvest, they break down quickly to release biomethane in the digestor.

Sourcing of Feedstocks

As supplement to conventional feedstocks, non conventional feedstocks such as **Common Reed and/or Reed Canary Grass** were considered.

- Non-conventional feedstocks were considered in the context of availability of low productivity agricultural lands in parts of west and south Offaly. The reeds have been shown to grow well, with positive dry matter similar to straw, subject to harvesting at appropriate times. . Preferably reeds should be harvested after senescence, baled and stored, prior to pelletising to feed to the AD plant. Growth of reeds may have the added advantage of reducing flood risk in 'post-peat' vulnerable areas by absorbing excess water during growth. In considering the Renewable Energy Directive and the Renewable Heat Obligation (RHO) requirements concerning sustainability, the study concluded that biomass feedstocks meet both the EU and Sustainable Energy Authority of Ireland (SEAI) sustainability criteria. Further consultation is recommended should the AD plant concept proceed to assure biodiversity and sustainability of feedstock sources.

The study indicates that a sustainable feedstock mix can be sourced locally, providing a reasonable return to participating farmers producing biomass (conventional and/or non-conventional).

Potential AD Models

Two provisional models are proposed to generate bioenergy in the west/ south Offaly area, close to Birr.

- **Commercial, medium-large scaled AD plant** at a brownfield 'antecedent' site, creating a nucleus for other synergistic enterprises.; and export electricity to grid and heat to a co-located commercial horticultural enterprise.
- 156 tonnes per day (tpd) of conventional and non-conventional agri-feedstocks, requiring
- 3,900 acres to grow the feedstock,
- Generating 3.4 MWe of electricity (2MWe export)
- output a volume of 206 tpd of digestate which will be valorised to add value to the economic model.

- **Smaller scaled, community based plant (500kWe)** within an existing agri-setting at Gurteen Agricultural College.
- 24 tonnes per day (tpd) of feedstock, from 93 acres,
- generate an output of 250 kW of electricity to complement existing renewable systems at the college by providing a base load and by heating accommodation blocks.
- Digestate volumes of 32 tpd, which with no further processing, could be used as a farm manure for Gurteen and local farms.

Benefits of AD (1)

Benefits of AD (2)

Benefits to Birr of an AD plant

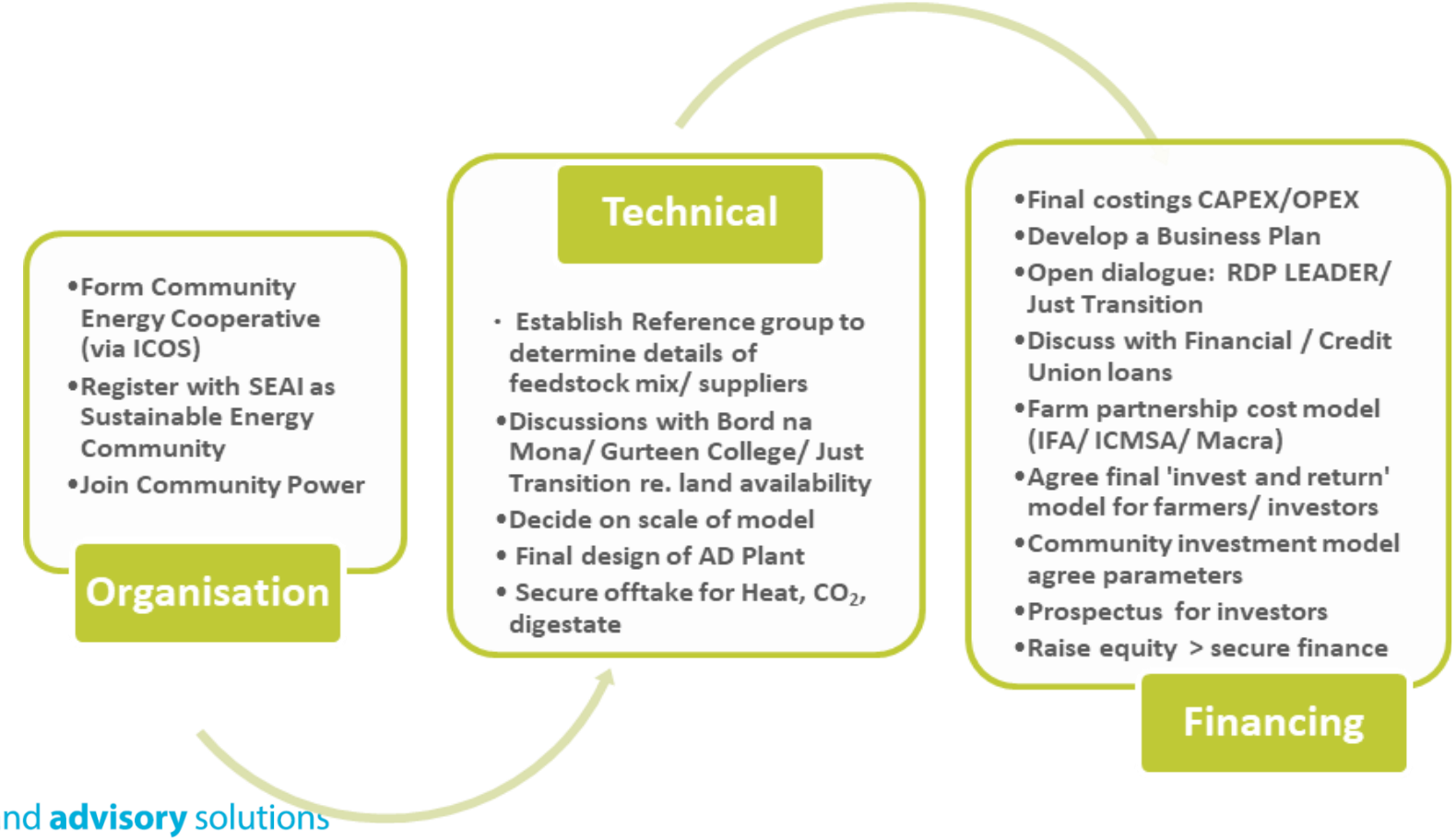
The study has shown that a community-based model for bioenergy generation is feasible, where all products of the process are used beneficially, including electricity, heat, carbon dioxide (CO2) and digestate to generate revenues..

✓	Generation of electricity:	29,943,916 kWh, sufficient to supply the needs of 6,891 homes
✓	Generation of heat:	17,395,294 kWh, sufficient to supply heating for 1,581 homes
✓	Production of:	4,106 tonnes of renewable fertiliser
✓	Creation of Employment:	3 F/T jobs, with multiplier jobs in feedstock, transport and supply
✓	Financial support of	€109,500 from state backed RHI scheme
✓	Potential CO_2 savings of:	15,558 tonnes p.a. from renewable heat and electricity generation

The study has also shown that feedstocks are largely available within the hinterland of Birr (less than 70km) and much of the non-conventional biomass could be generated in west/ south Offaly from traditionally less productive lands.

Next Steps (Road Map)

It is proposed that Birr 20:20 carry out the following steps to commence the process of developing a viable community-based AD plant in south Offaly:



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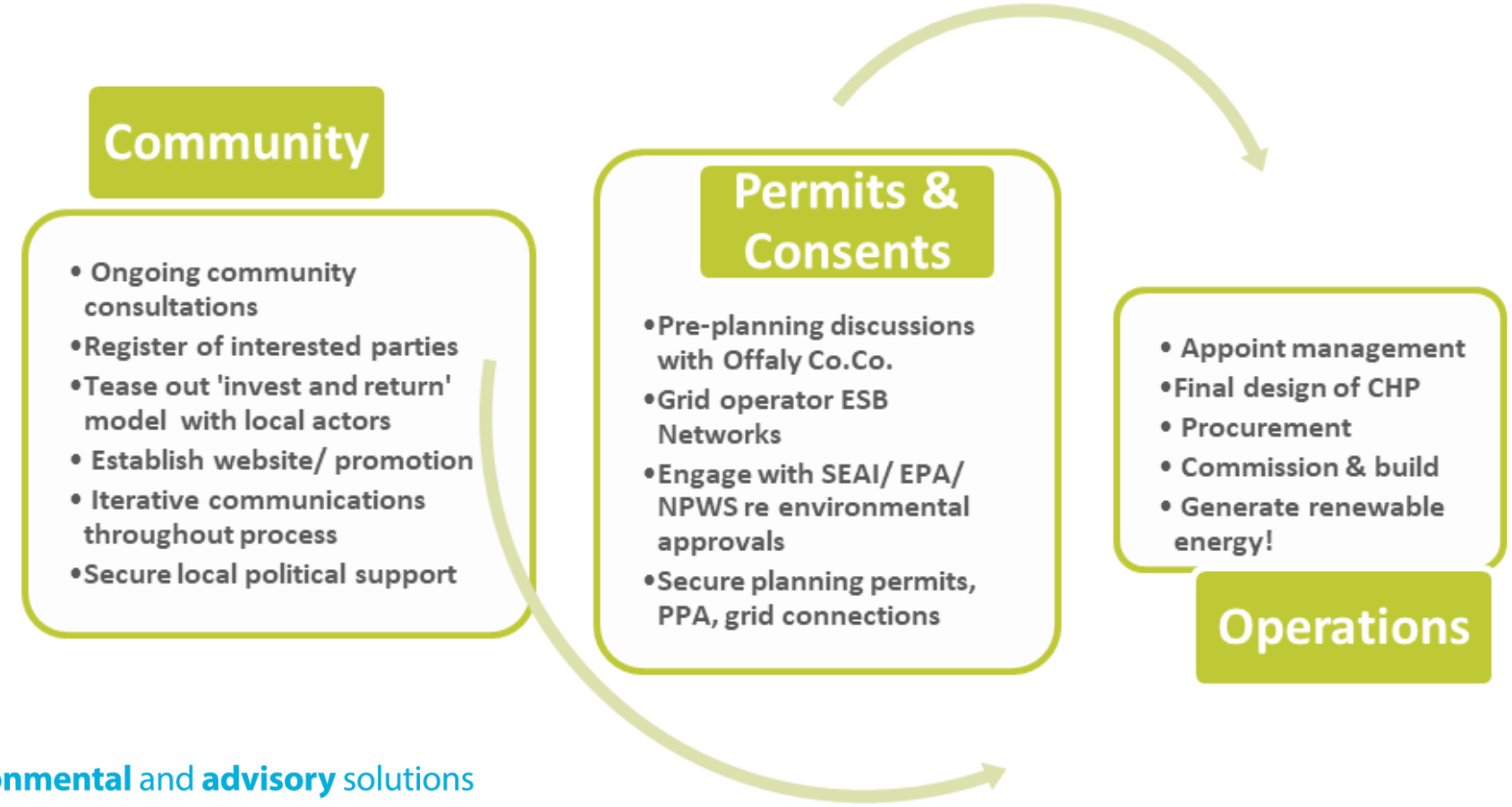

Next Steps

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The idea is you use this slide as a reference for creating your own slide, with your content, in a similar style to how this looks. This is a load of text to fill up the page for the purpose of showing layout designs.

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