

# CAST SEAWEEEDS POTENTIAL valorisation ON ISLE OF WIGHT (UK)

BDI-2021-ICE

Deliverable 3/3  
Jan 12th 2022 v1



**Interreg**  
France ( Channel  
Manche ) England



**BRETAGNE**  
**DÉVELOPPEMENT**  
**INNOVATION**



**redéo**  
ENERGIES

**OLIGONOV**  
Laboratoire



# Background

- IoW joined the european funded program called **ICE**.
- It aims **design, implement and promote innovative smart energy solutions for isolated territories**
- Can available seaweed be valorized into energy ?
- BDI answered with its network through this study





# Project objective – the scope

## Problematic

Smell nuisance and cost of removal impact stakeholders on the island

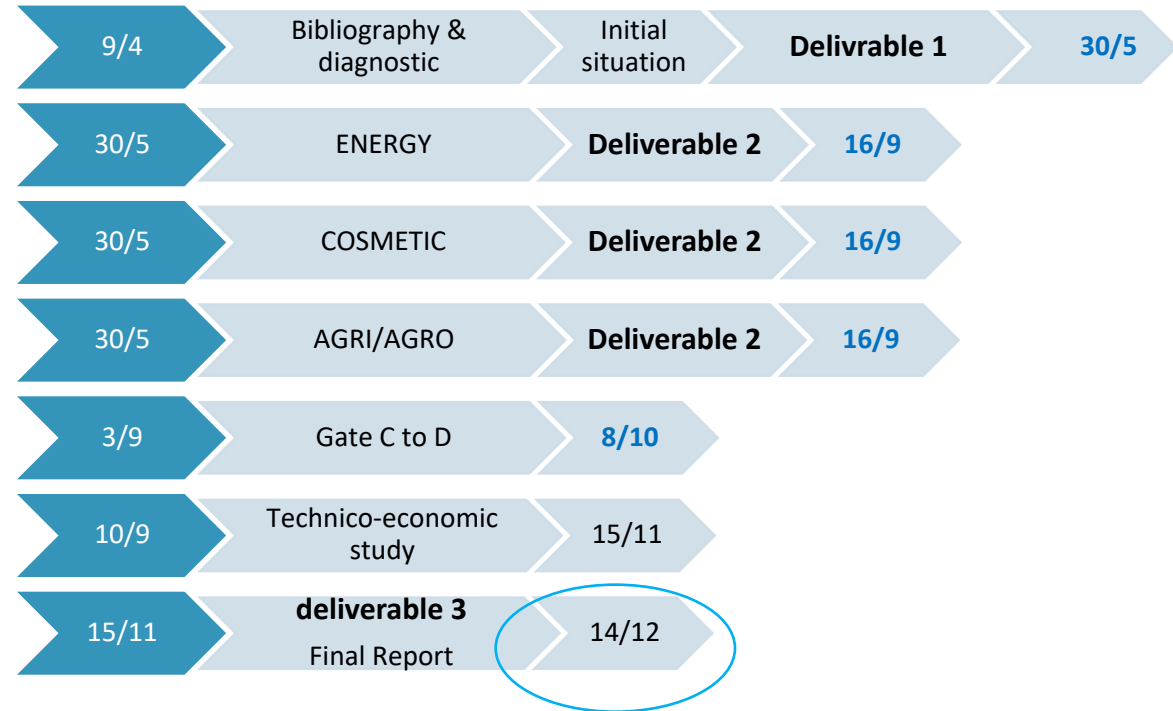
## Solution

Explore ways to valorise this resource and propose feasible solutions in

- ENERGY
- COSMETIC
- AGRI-AGRO

## Mai Background papers

- ✓ Cheetah Marine increase cost of removing Ventnor Harbour's seaweed to £87,420 a year.pdf
- ✓ Seaweed removal stats 2009-2021.xlsx
- ✓ 2011.05 East\_Cowes\_seaweed\_Project.pdf
- ✓ 170911 Ventnor Haven hydrology report.pdf
- ✓ NBN Atlas species Isle Of Wight.xlsx



# Seaweed quantities

	Total material qty per 5 months of year (estimate)	Part of seaweed (estimate)
East Cowes	3,500 m <sup>3</sup>	2009: 126T 2010: 212T 2010-07: 300T 2021: 800 m <sup>3</sup>
Ryde	24,000 m <sup>3</sup>	20,000 m <sup>3</sup> ***
Sandown	1 m <sup>3</sup>	1 m <sup>3</sup>
Shanklin	1 m <sup>3</sup>	1 m <sup>3</sup>
Ventnor – mud	60,000 m <sup>3</sup>	20,000 m <sup>3</sup>
Ventnor - seaweed	200 m <sup>3</sup>	200 m <sup>3</sup>
Bembridge	8,000 m <sup>3</sup> *	4,000 m <sup>3</sup>
Totland	3,000 m <sup>3</sup>	500 m <sup>3</sup> **
Total mud		20,000 m <sup>3</sup>
Total solid		24,700 m <sup>3</sup> 18,500T

-> Measure output solid/liquid

Sources:  
East Cowes test collection 2009-2010  
Alimah Bhatti's internship: observations in August 2021

**Yearly solid biomass expected to be collected is 24,700m<sup>3</sup> or 3700T / month during 5 months. It worth deciding means for collection.**



# Sampling for lab analysis & AD plants



1



2



3



Bembridge – Totland: 24 miles  
 Cowes – Niton: 14 miles

A: black Dog  
 B: Wight Farm

# Part 1: Situation conclusions

Seaweeds are the result of natural phenomenon combined with human activity

Prior to valorisation, seaweeds needs to be **collected** and **treated**

**Nuisance** is to eradicate because of public health and discomfort

**Cost** is to reduce... but

- handling, valorising will require means, workforce, investment
- Valorisations to compensate collection or avoid losses

87,420 £/ year to reduce for 60 000m<sup>3</sup> pumped

20 000 m<sup>3</sup> seaweed + 40 000 m<sup>3</sup> sea water estimate

⇒ 15,000T fresh seaweed (1,500 t dry matter)

⇒ £ 6/t fresh wet seaweed





## Part 2 – Valorisation conclusions



Establishing measures of quantity, regularly through observations and quadra measurement is recommended.

Yearly solid biomass expected to be collected is 24,700m<sup>3</sup> or **3700T / month = 18,500T/y** during 5 months. It worth deciding means for collection.

- Valuable and collectable seaweeds mainly appear in **Bembridge** and **Ryde**.
- Ryde + Ventnor sample shows **biomethane interest** with 204 kwh HHV / t wet matter.
- **400 homes heated + 200 electrified by seaweed per year (assuming 3000 KWh/home/y)**
- **East Cowes** collecting **experience** in 2010 was successful at £8/T cost (manpower) or 48£/T (+transport, landfill).
- **Ventnor** mud pumping is the consequence maritime entry due to harbor design forming a still water bay. **Dredging remains necessary combined with regular means on wet seaweeds.**




Species appears in large variety (green, red, brown) as a mix with difficulties to indicate a quantity per specie. This **rough, stable, non-pure** material keep their **benefits** but **raw cast seaweed is not suitable for ingredient.**

## Part 3 – Economic study

Activity	Unit cost	cost	benefit	risk
« Do nothing » pumping		0 (87k£ +15%/y)		Discomfort, public health damages Tourism affected
Dredge in Ventnor	5 £/t (est.)	< (85,000 £)	17,000 m <sup>3</sup> sediments removed	Related to harbor
Collect 18,500 t seaweeds fresh	45 £/t	(832,500 £)		<b>832 k£ expense to collect for IoW</b>
Sell 6200 t dry seaweed to AD plant	15 £/t		93,200 £	
- Cost for digestate spreading + agronomic value		(13,000 £)		<b>80k£ revenue for IoW council</b>
Produce energy from 6,200 t dry seaweed	58 £/t		355,000 £	<b>355k£ revenue for AD plant</b>



# Part 3 – Pilot action plan for 5% seaweed collection

Activity	Available Tools	Available partner	Validation milestone	£
Do nothing	0	0	Public acceptance Loss in tourism revenue Public health	
Dredge <b>8,000t</b> in Ventnor			Environmental impact Fishery activity preserved	(40,000 £)
Collect <b>1000 t</b> seaweeds fresh	Loaders..	AD plants	- Sun drying efficiency - Ensilage quality - Storage capacity	(45,000 £)
Sell <b>335 t</b> 30% dry seaweed to AD plant	Transport		- Inhibition inactive - Sand content	5000 £
- Cost for digestate spreading + agronomic value		Farms	- Existing AD plants, including R&D - Partnership contract	(700 £)
Produce energy from 335 t dry seaweed		 bioQUBE	- Investigate further a mix with household waste	<b>19,000 £</b>
Total (net)			- no pumping alone - no landfill disposal	<b>-61,000 £</b>



# Deliverable list

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## Deliverable 1

ICE-IOW Invasive seaweeds situation 2021.05.31 FINAL

## Deliverable 2

ICE-IOW Deliverable 2 - valorisation 2021.09.16  
ICE IoW Deliverable 2 Conclusions 2021.09.29

## Deliverable 3

BDI2020-ICE Valorisation of seaweed on IoW - Economic study ENG

BDI-2021-ICE-IoW-phase 2-report 1\_Seaweed energy valorisation regarding government incentives for AD.pdf

BDI-2021-ICE-IoW-phase 2-report 2-Feeding existing Wight Farm Energy AD plant with a proportion of cast seaweeds.pdf

BDI-2021-ICE-IoW-phase 2-report 3-Feeding existing Black Dog Biogas AD plant with a proportion of cast seaweeds.pdf

BDI-2021-ICE-IoW-phase 2-report 4\_New AD plant construction.pdf

**Feedstock inlet**  
50% grass silage  
50% maize silage  
~145 t/day – ~55 000t/year



**Feedstock inlet**  
(mixed with digestate recirculation)  
No premix onsite



~62 000 MWh HHV/y

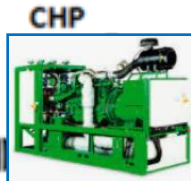


use as fertilizer



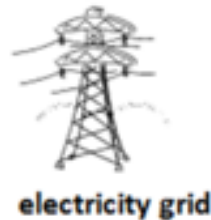
**Digestate to farmers**  
~41 000t/year  
~325 t N/y (nitrogen)

Liquid-phase 7.5/8.5% DM  
48°C  
60 days residence time  
100 ppm H<sub>2</sub>S (max 250 ppm)



Digester heating during winter

250 kW CHP ~2 000 MWh electricity



CO<sub>2</sub>

820 kg/h CO<sub>2</sub> production ~ 7300 t/y



CO<sub>2</sub> epuration & liquefaction  
(Pentair)

Liquid food-grade CO<sub>2</sub> to beverage company

Biogas upgrading to biomethane  
(Pentair)

CH<sub>4</sub>



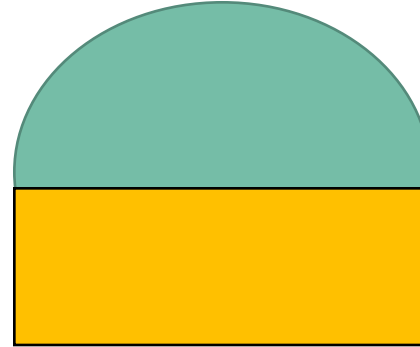
580 Sm<sup>3</sup>/h bioethane injection capacity  
~52 000 MWh HHV

# Wight farm energy AD plant – with seaweed

**Total feedstock: 58 400 t**

(+3 083 t/year)

- maize silage: 42%
- Grass silage: 47%
- Seaweed @30%DM: 11%



Wight Farm Energy AD plant



**Total digestate: 40 400 t**

(+3 685 t/year)

(+29 t N/year)



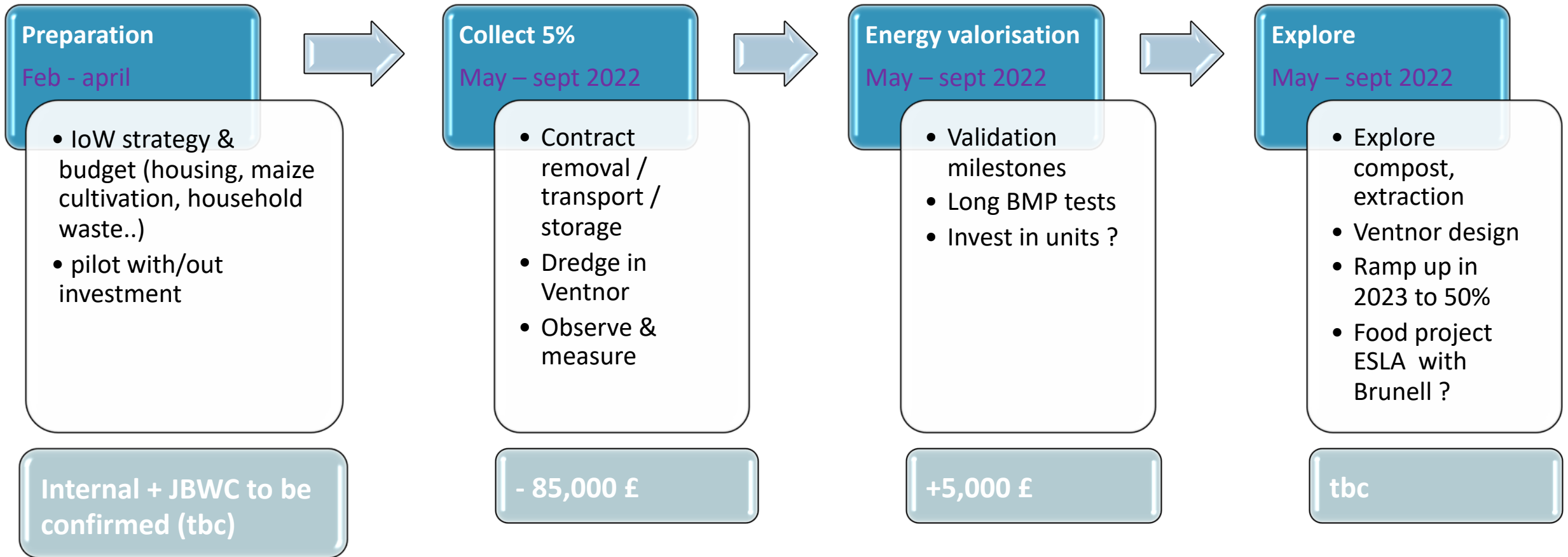
**Same energy production:**

- ✓ Electricity: ~2 000 MWh
- ✓ Biomethane: ~52 000 MWh
- 5,4 % from seaweed

Seaweed feedstock proportion if AD is fed only during the 5 summer months with them: **22%**

Seaweed feedstock proportion if AD is fed all along the year (ensiled seaweed that can be stored): **11%**

# Coming next in 2022 for IoW



Some Funding opportunities:

<https://www.gov.uk/guidance/european-territorial-cooperation-programmes>

<https://www.gov.uk/government/publications/apply-for-the-biomass-feedstocks-innovation-programme>



# Q & A



Thanks for your attention and interest in seaweeds !