v.d. WIJNGAART'S

ENGINEERING SERVICES

Presentation

From crop to electricity

Engineering, Consultancy, Innovation and Licensing

1. Introduction

- From crop to electricity

More specifically

- From sugar beet to electricity

2. Introduction
Van der Wijngaart ‘s Engineering Services (WES)

- Dutch Engineering company (SME) started 1988
- Employs initiatives to solve actual problems in agricultural sector.
- Consider operations as “black box” function.
- Solves problems with “Lego” like modules.

3. Present sugar beet production

- Seeding beets at individual distances of 25 cm
- Crop growing time 6 – 9 months
- Yield 70 tons/ha excl. leaves (equals to 80.000 beets)
- Input minerals: N, P, K, Mg, S, Na and B
- Consumption of CO_2 crop = 36 tons/ha
- Reject of O_2 of crop = 18 tons/ha
- Dutch surface covered by beets: 120.000 ha
- Farmers income € 50/ton (less leaves)
- Production of 10 million beets in open fields takes 120 ha

4. Conclusion

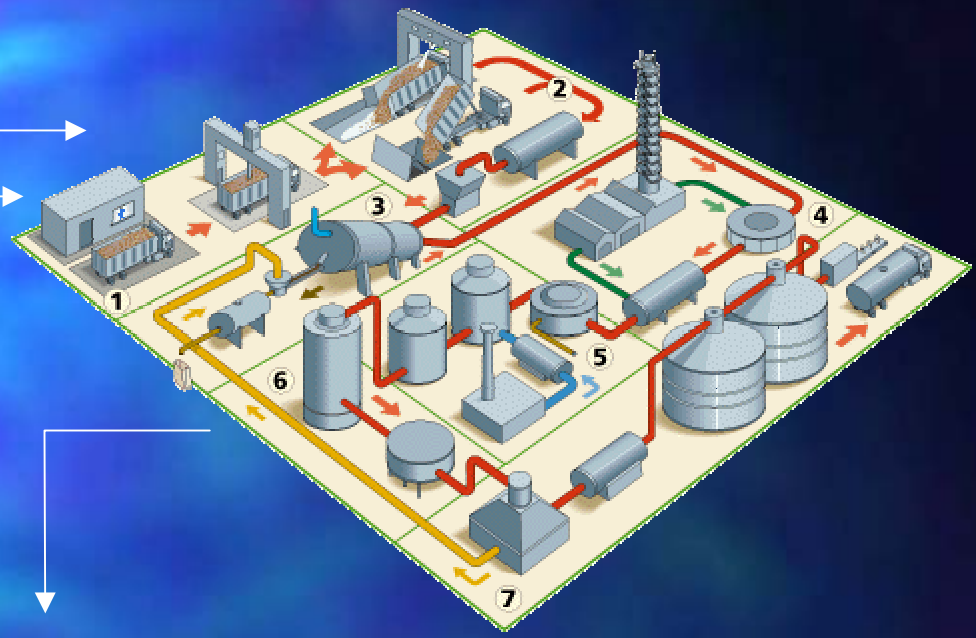
- Present method of beet production to generate electricity is not feasible due to limited yield per hectare.

5. Present sugar beet production

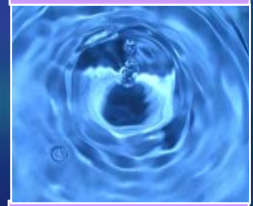
INPUT CO_2, coke, energy, gas,water, lime

INPUT

Transport 100 - 150 km



OUTPUT

Melasse	Cattle food	White sugar	Water	Chemical waste
				
3 %	7 %	15 %	75 %	
Modified into yeast	Dry € 100/ton	€ 600/ton		

6. Present sugar beet production

- Sugar production is up to now very attractive due to high subvention by EU
- This support will disappear due to commission ‘s decision (30 % reduced)
- Sugar production will not be feasible anymore, because of:
  - Low yield per hectare.
  - Less subvention.
- Sugar beet production will not be very attractive either to generate electricity,

UNLESS

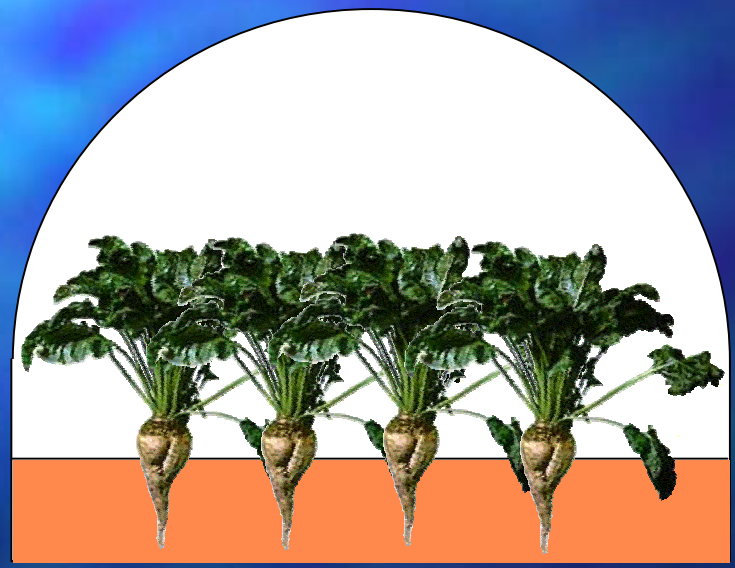
7. Present sugar beet production

- UNLESS higher yields can be obtained.
- UNLESS waste resources can be used.

What could be such a solution?

8. Solution

- Floating beet production in (simple) greenhouses



9. Higher yield can be obtained by:

- Increasing CO_2 contents in greenhouse. →
- Heating of greenhouse on colder days. →
- Supply sufficient nutrients. →
- Year round production.
- Give beet plants sufficient space if they need it.

10. Free resources from (pig)farmer

Input
Food
€ 550.000,-

5.000 pigs

CO_2
Heat

Manure
Disposal cost
€ 70.000/year

Water
Minerals

Potential loss
€ 160.000,-
€ 130.000,-

Ingredients for accelerating beet production

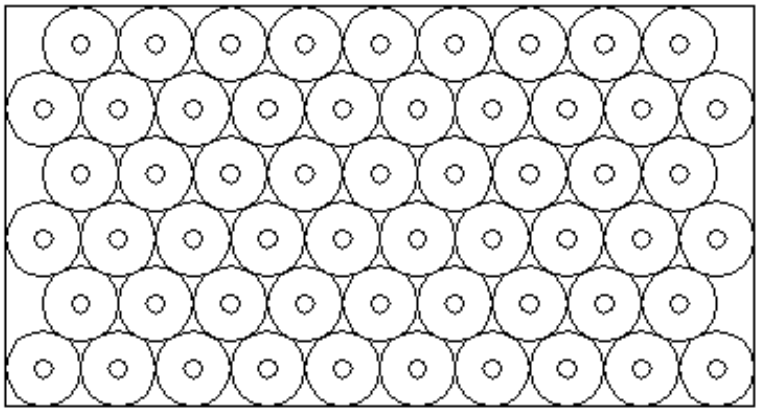
11. Symbioses

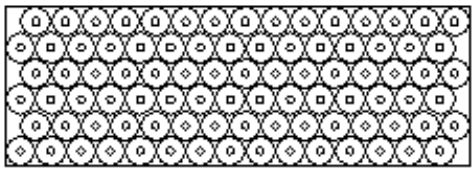
+

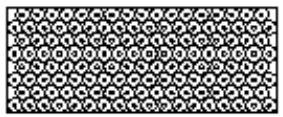
= Economical beet production with "waste resources"

Symbioses
1 + 1 =3

12. Spacing of beets in a greenhouse
Normal spacing in open fields for 10 million beets

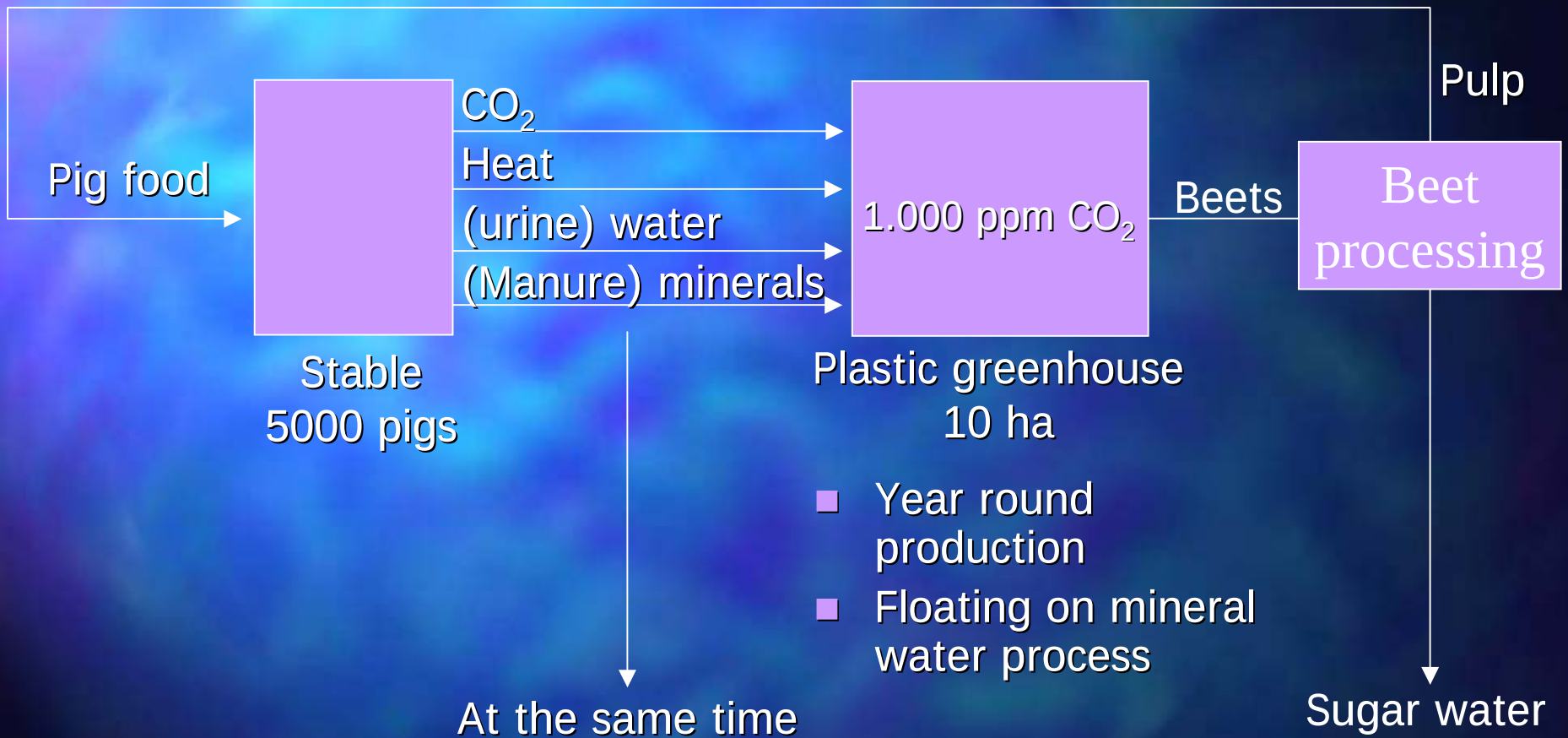




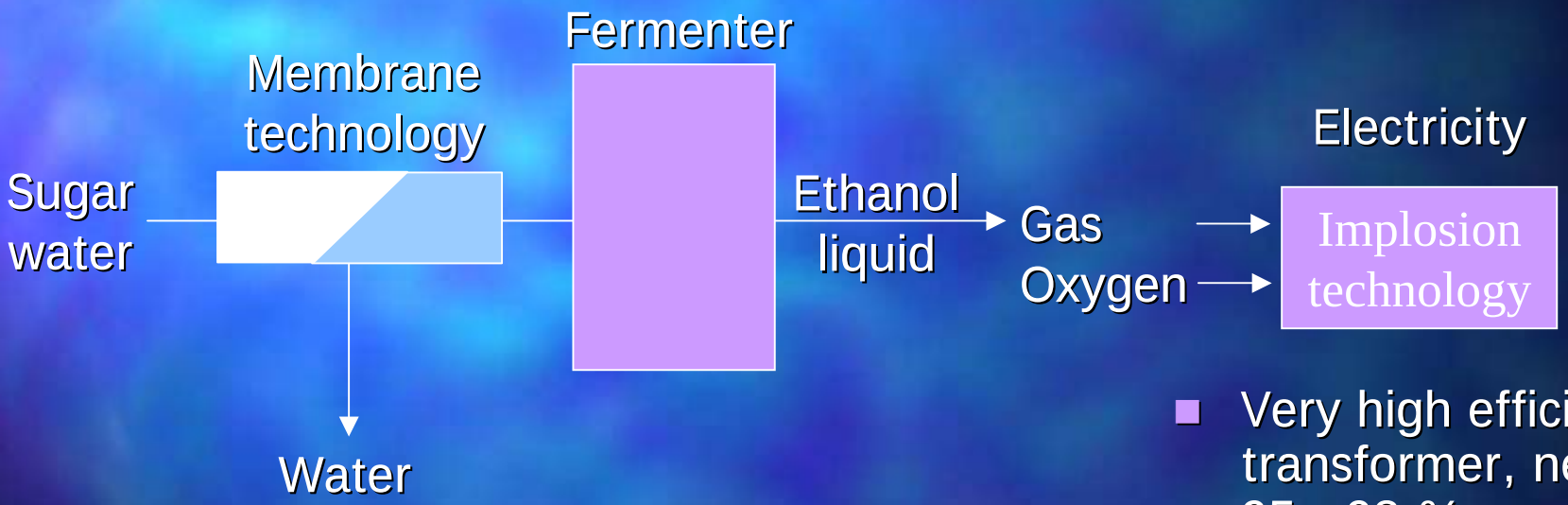


	Size	Time
Finishing area Plugs of rockwool of 0.25*0.25	8.16 ha	8 weeks
Growing area Plugs of rockwool of 0.1*0.1	1.3 ha	8 weeks
Development area Plugs of rockwool of 0.05*0.05	0.24 ha	6 weeks
Germination area seeds without lighting in rockwool	0.08 ha	2 weeks
Spacing as required in floating process for 10 million beets	**10 ha**	24 weeks (6 months)

13. New approach to sugar beet production

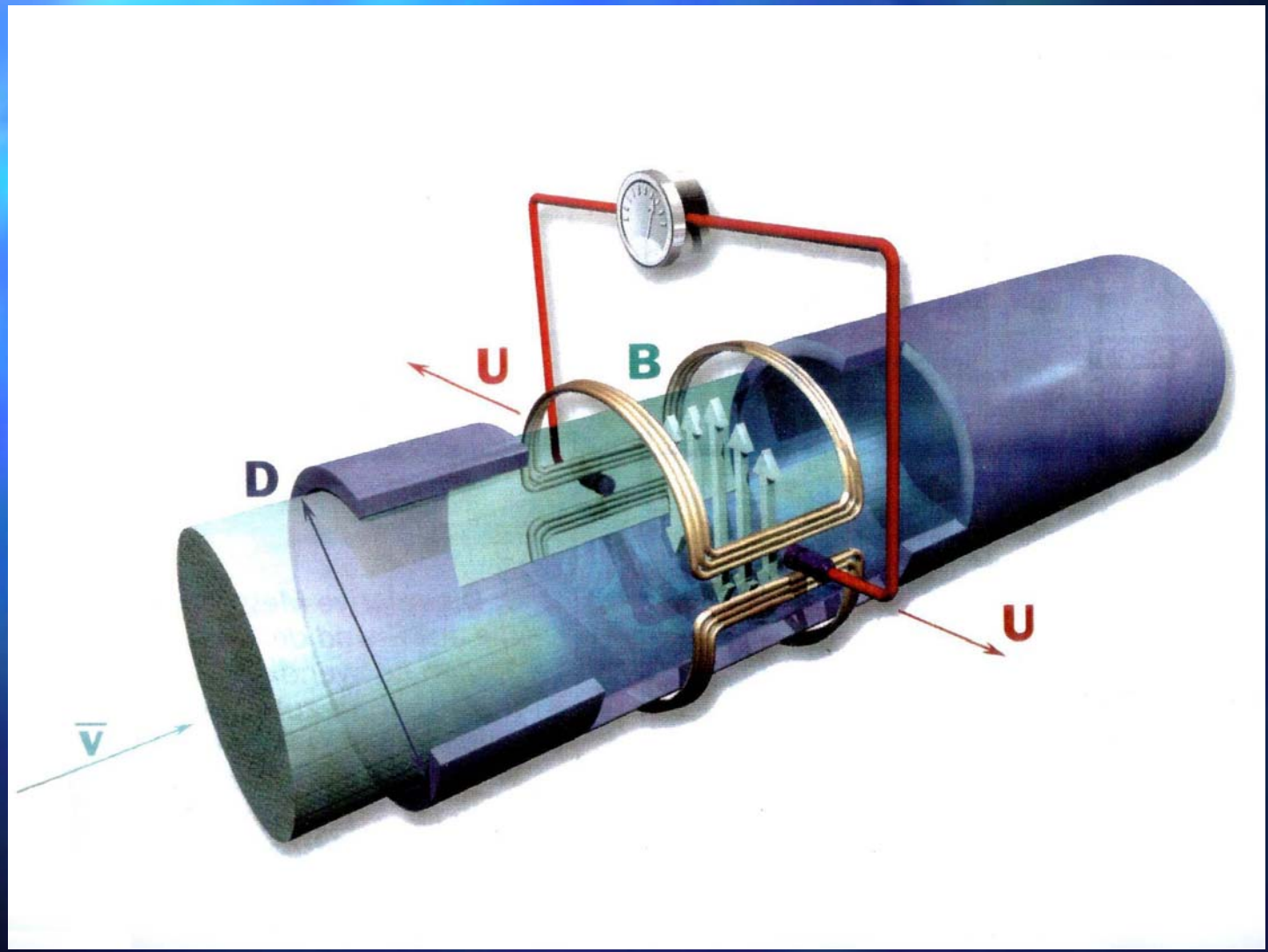


14. Electricity production

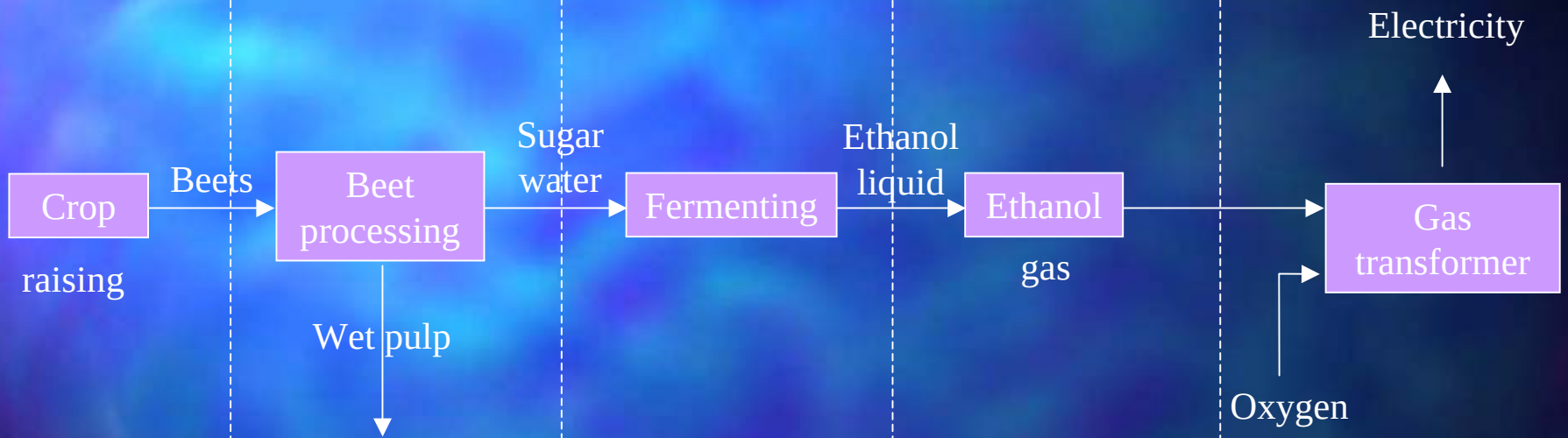


- Very high efficiency transformer, nearly 95 - 98 %
- Chemical energy transformation

15. Gas transformer implosion technology



16. Partners requested to generate electricity (decentralized) production on farmyard



- Research partner verifying process
- Greenhouse builder
- Stable builder

- Miniaturization parts of sugar processing
- Food processor

- Fermentation technology to build smaller units

- Ethanol research to make liquid suitable for gas transformer

- Research to chemical energy transformation