



Europa investeert in uw toekomst uit het Europese Fonds

FLEXIGAS

1

TNO innovation for life

Flexible Biogas Chain Simulator





A Landfilling Site



Slide 2

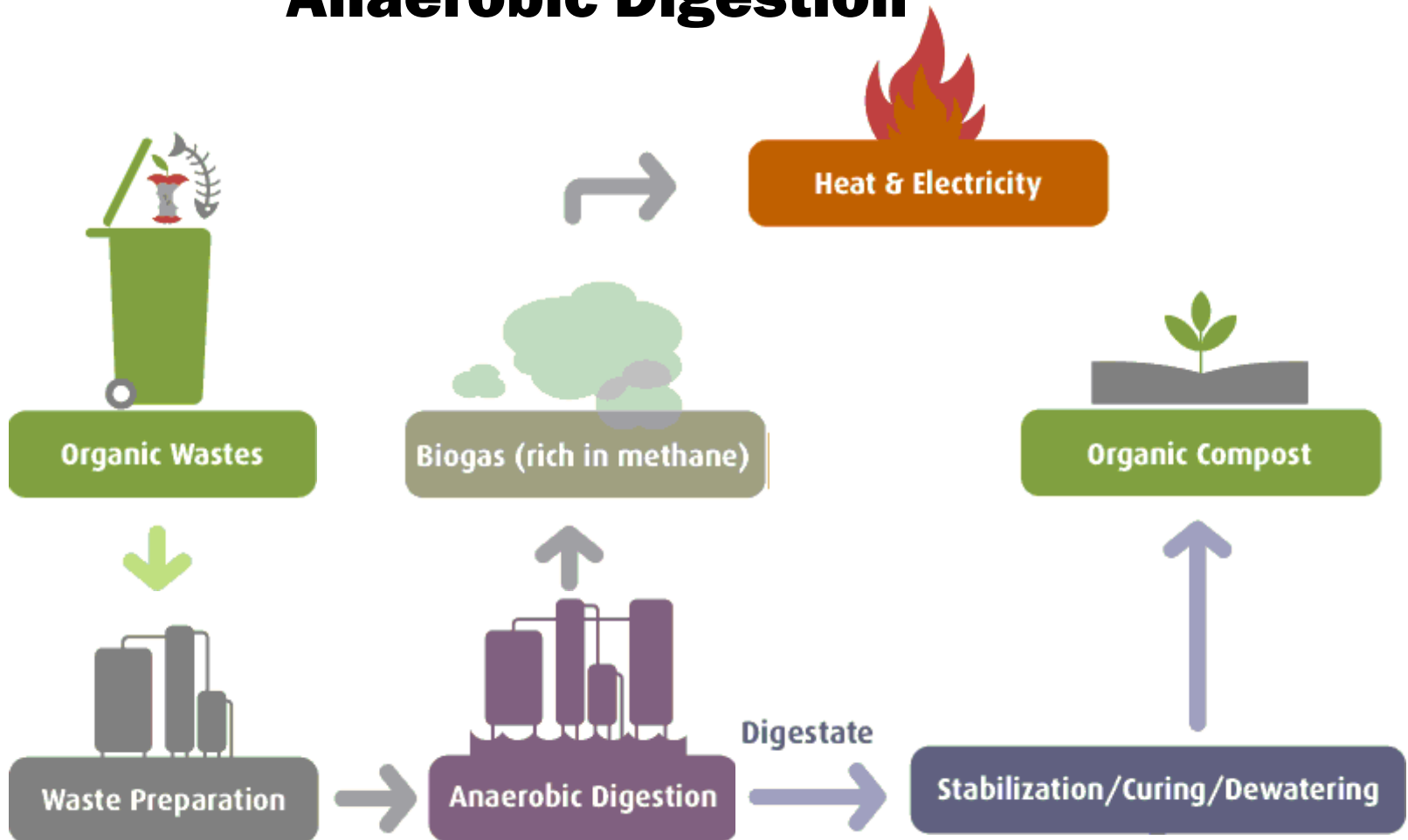
A1

Check composting facility title and reference for pictures

Author, 8/20/2013



Anaerobic Digestion





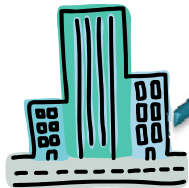
Biogas Chain



Manure



Agricultural waste

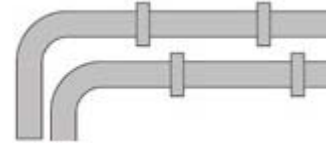


Organic municipal waste

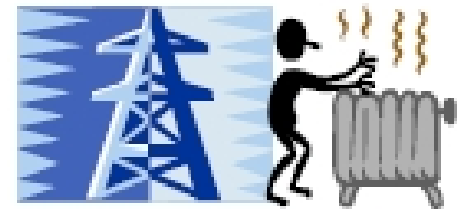
Truck Transport



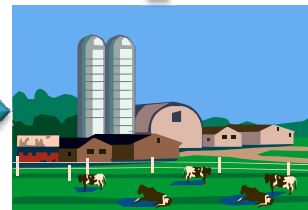
Pipe Transport



Electricity and Heat Production



Anaerobic Digestion Facility



Gas Cylinder Transport



Truck Transport

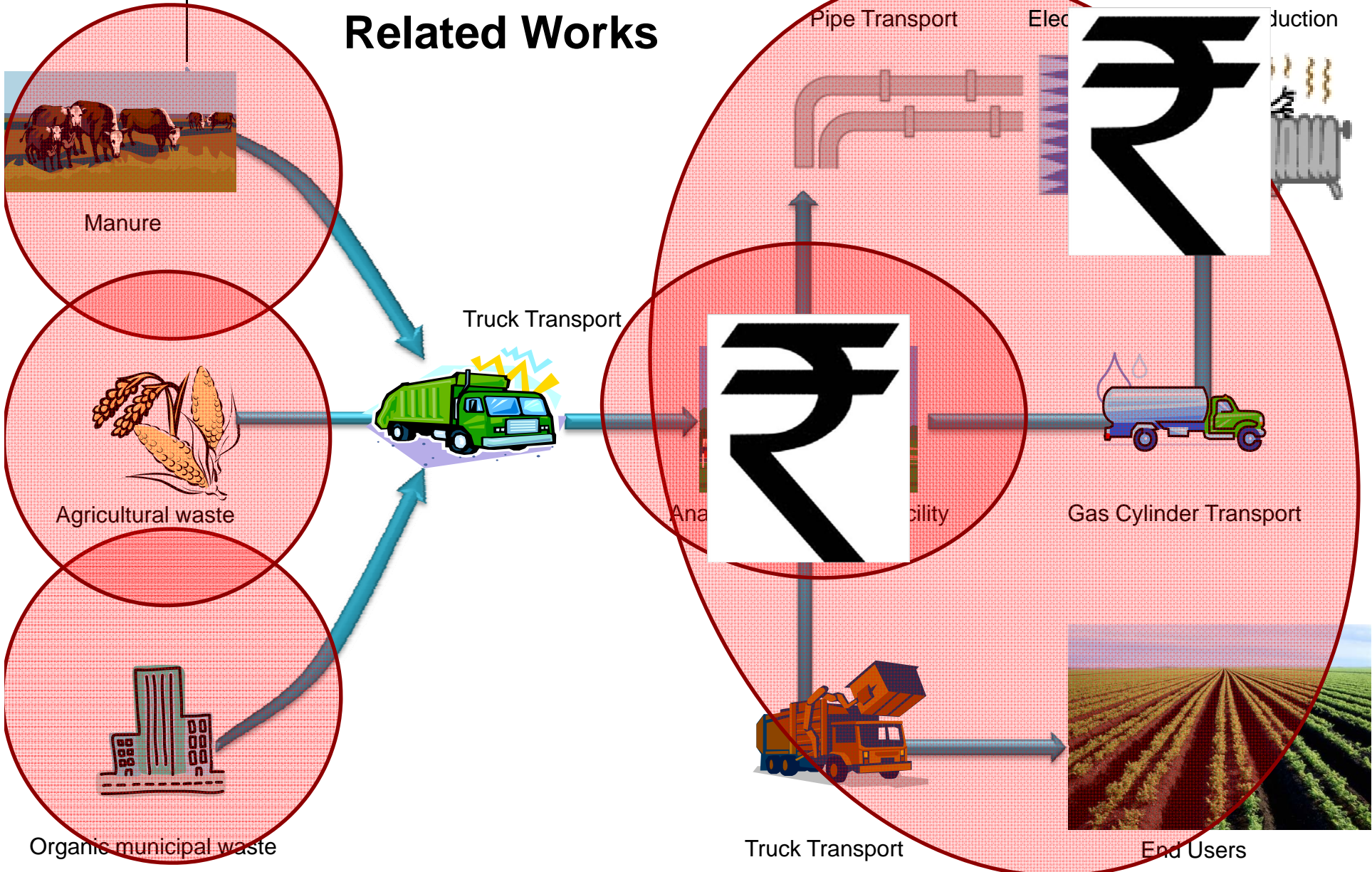


End Users





Related Works

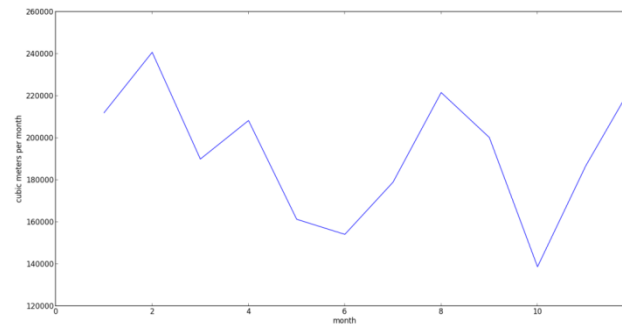
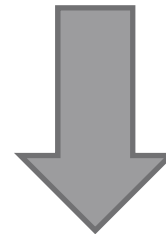
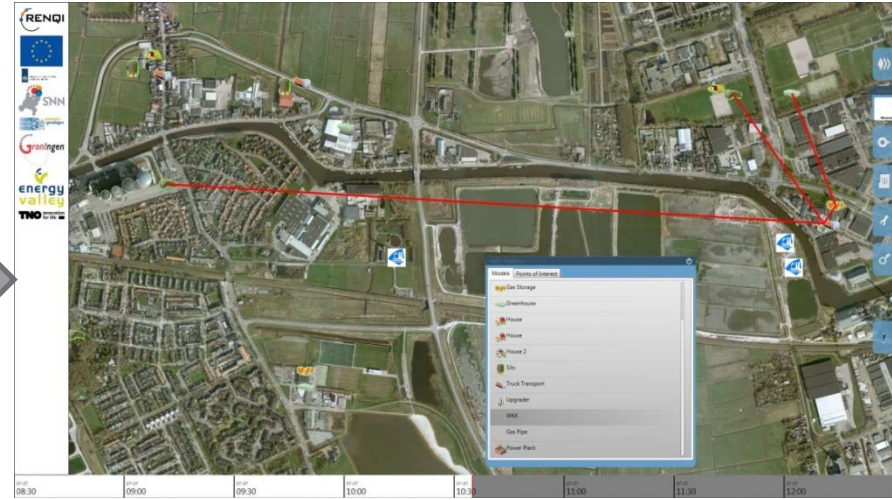
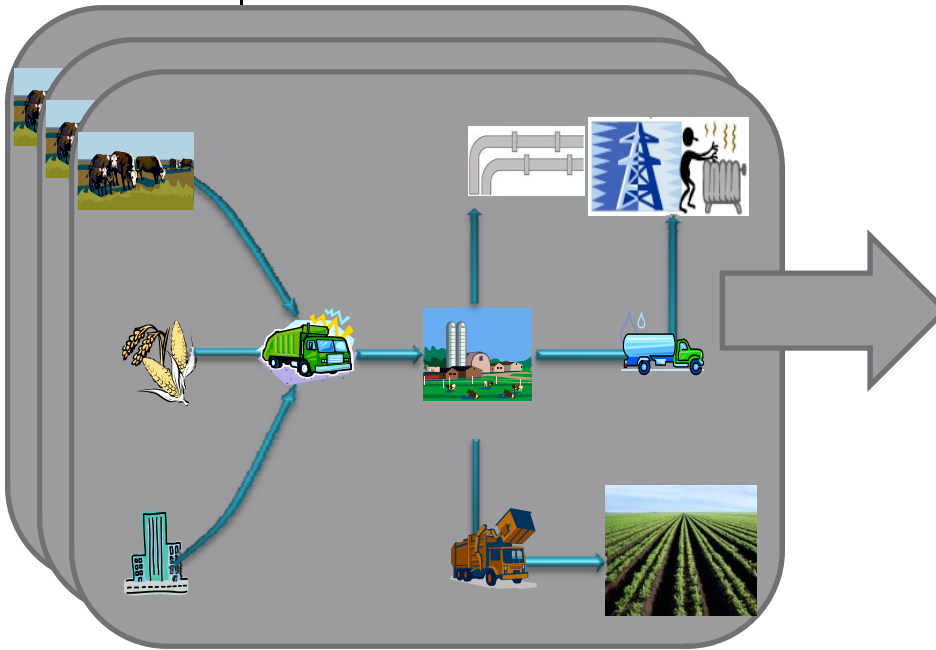




Europa investeert in uw toekomst uit het Europese Fonds



Decision support tool





› Modelling

- › Design reusable components
- › Using Modelica
 - › Open Source language
 - › Declarative and Object Oriented
 - › Domainless modelling language
- › Configurable and scriptable



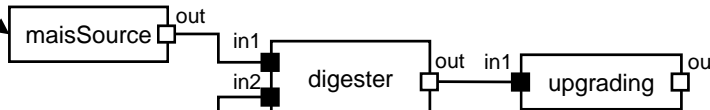
Simple Chain

```

organicDryMass = 0.426
gasPotential   = 600
methanePotential = 330
nContent       = 0.046
pContent       = 0.019
kContent       = 0.055
rate           = 1.528
  
```

```

organicDryMass = 0.07
gasPotential   = 300
methanePotential = 180
nContent       = 0.0526
pContent       = 0.017
kContent       = 0.068
rate           = 1.528
  
```



```

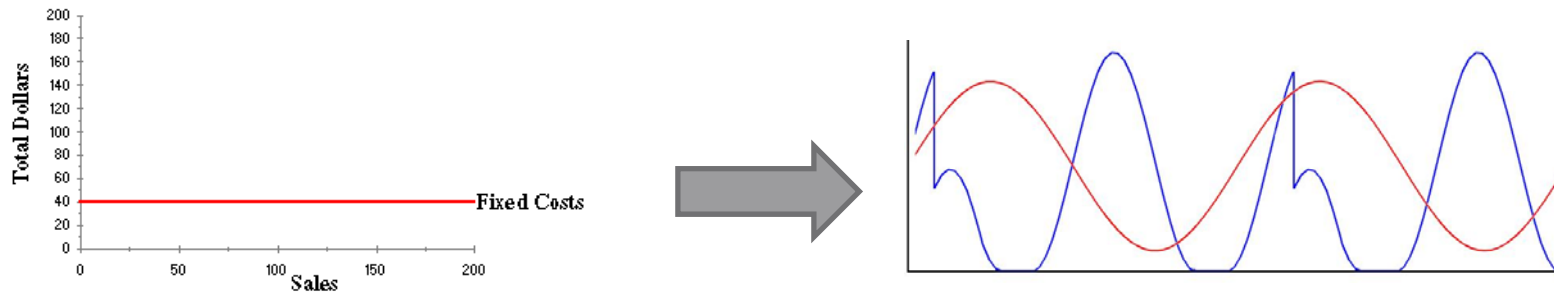
model EenvoudigeKeten
  SubstrateSource maisSource(organicDryMass = 0.426, gasPotential = 600,
methanePotential = 330, nContent = 0.046, pContent = 0.019, kContent = 0.055, rate =
1.528);
  SubstrateSource manureSource(organicDryMass = 0.07, gasPotential = 300,
methanePotential = 180, nContent = 0.0526, pContent = 0.017, kContent = 0.068, rate =
1.528);
  Digester digester;
  Upgrading upgrading;

equation
  connect(maisSource.out,digester.in1);
  connect(manureSource.out,digester.in2);
  connect(digester.out,upgrading.in1);
end EenvoudigeKeten;
  
```




Scientific progress in Life Cycle Analysis (LCA)

- From Static to Dynamic simulation



- Focussing on People, Planet & Profit all at once



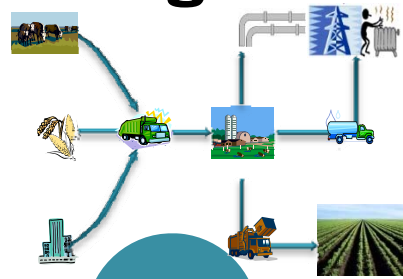


Europa investeert in uw toekomst uit het Europese Fonds

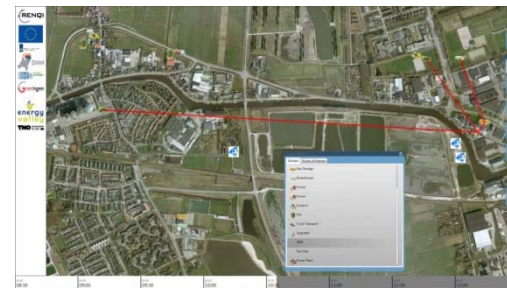
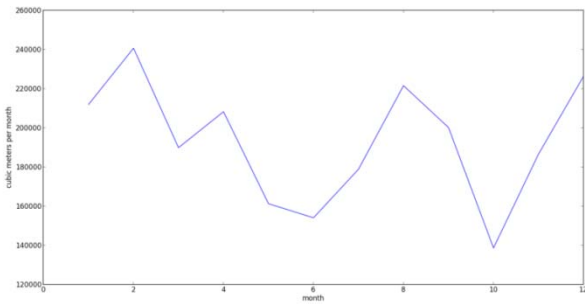
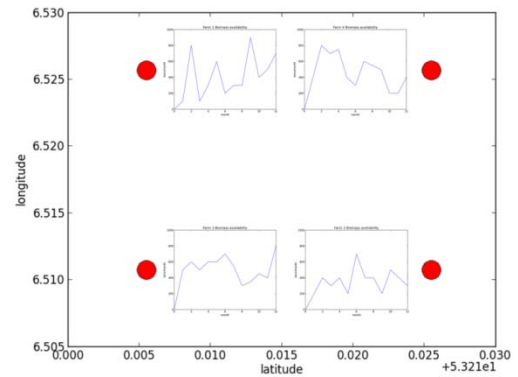
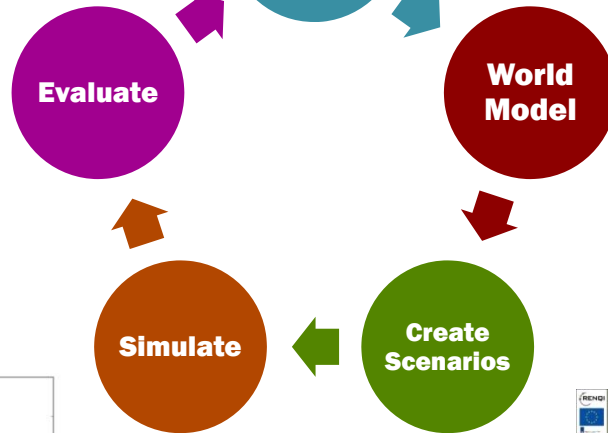
FLEXIGAS

TNO innovation for life

Simulation & Planning Process



People ↑
 Planet ↑
 Profit ↑





› **Conclusion**

- › ICT based tool that gives a complete and computational overview of the bigas chain
- › Anaerobic digestion helps reduce the problem of waste disposal and also creates a renewable source of energy
- › Helps decision making process and show what needs to be done to facilitate the process
- › Create Business opportunity for waste management & efficient production and usage for BioGas & Digestate
- › Impact on People Planet Profit



Questions??

We are looking to collaborate with interested stakeholders in India!!

If you are interested please contact **madan.rajagopal@tno.nl** for additional information.