



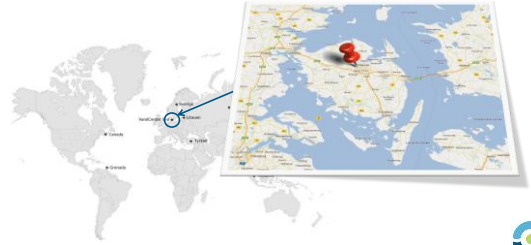
Denmark - 16 years on from the landfill ban

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Odense - the 3rd largest city in Denmark

192,000 inhabitants



VCS Denmark Main activities

- Production and distribution of drinking water
- Disposal and treatment of wastewater
- Operational services, training and consultancy on home and foreign markets



Our vision and company values

- We wish to be a role model - locally, nationally and internationally.
- We wish to create maximum value for our customers - and to exceed their expectations.



History of VCS Denmark

- In 1853 Odense Waterworks were established (first in Denmark).
- In 1864 the first sewers were built.
- In 1907 the first wastewater treatment plant Ejby Mølle was built.
- In 1994 Odense Water Ltd. was established as a result of a merger between Odense Municipality's Water and Wastewater Departments.
- In 2010 Odense Water Ltd. changed its name to VCS Denmark Ltd.



VCS Denmark Key figure



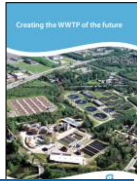
- **Water supply**
 - 45 production wells – groundwater
 - 6 waterworks
 - 10 mill. m³ supplied water per year
 - 1,014 km of pipeline
 - 48,500 water meters
 - 155,000 inhabitants supplied
- **Wastewater**
 - 756 km² catchment area
 - 2,153 km of sewers
 - 287 pumping stations, main sewers
 - 8 treatment plants
 - 36 mill. m³ treated per year
 - 220,000 inhabitants supplied



VCS Denmark WWTP – now and in the future

Our objectives:

- VCS wish to be CO₂ neutral in 2014
- We are doing our best to optimize the current situation and at the same time prepare for the future.
- A critical approach to everyday operation
- On the outlook for new technologies.



VCS Denmark WWTP – now and in the future

Our future

- One world class WWTP for the entire utility
 - Energy producing – electricity and heat
 - Nutrients recovery
 - Greenfield construction
- Cooperation between 27 utilities in establishing a large sludge incineration plant
 - Price attractive incineration – 200.000 tons per year
 - Operated and owned by the utilities
 - Phosphorus recovery



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Status for the organic waste fraction in Denmark

- All organic waste are incinerated – very wide spread use of district heating
- It is not legal to use landfill for organic waste – since 1997
- Limited use of Food Waste Disposers (FWD)
- Installation regulated by local authorities
- Approval based on perception and not on facts.



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Background for the investigation

- Danish water companies and municipalities wish to have a better basis for allowing or rejecting the installation of food waste disposers in private households.
- FWD's are installed because it is a convenient and hygienic way of quickly disposing food waste in the kitchen
- Exploit the energy potential in the waste at wastewater treatment plants with and without digesters.
- The investigation paid by DANVA (Danish water and wastewater federation) and 3 major utilities.
- Produced by COWI – major Danish consultant



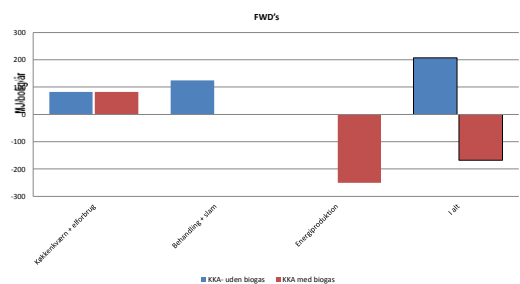
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Aim

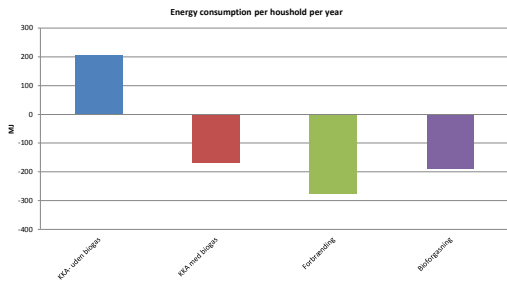
- Assessment of the affect of food waste disposals (FWD) on the operation of sewer systems, wastewater treatment plants and solid waste management and the effect on exploiting the energy in the food waste.
- Environmental consequences for directing food waste to incineration, biogas production or to a wastewater treatment plant are investigated
- To bring some facts into the debate on FWD's



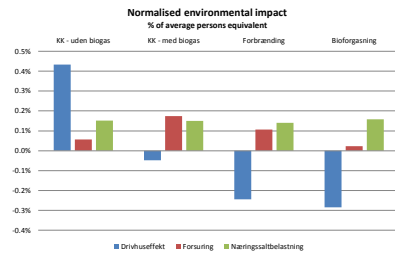
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Future for FWD's in Denmark

- More educated regulators.
- Usage and installation has been deregulated in Odense in a trial period.
- More focus on energy balance and CO2 footprint.
- Carbon might become a limited source.
- More FWD's installed over time – but most likely only in limited numbers.



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Conclusions

- Sewer systems with a long retention time the problem of formation of hydrogen sulphate can be exacerbated by adding food waste to the wastewater.
- There has been found no support in the claim that food waste from private homes which is directed to the sewer system can lead to sedimentation, problems with FOG (fat, oil, grease) or lead to an increase in the rat population in the sewer.
- Wastewater treatment plants are impacted through an increase in the organic load on the plant. The impact from nutrients and toxic compounds are of marginal importance.



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Continued

- The organic fraction of house hold waste is approximately 20-30 %. If FWD's are installed in all or a majority of homes in urban area, the frequency of collecting solid waste from households can be reduced
- The potential energy food waste is most efficiently exploited in incineration plants with generation of power and heat.
- The second best exploitation is in biogas plants and the least is by directing the food waste to a wastewater treatment plant.
- The largest reduction in emission of greenhouse gasses is achieved in biogas plants.



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Continued

- There can be situations in new urban developments where it would be an overall advantage to remove the food waste by using FWD's.
- The reason why less energy is exploited from food waste that is directed through the sewer system to a wastewater treatment plant is that in wastewater treatment plant (with primary clarifiers), approximately 40 % of the COD is lost in the process tank and through the effluent.
- The energy and environmental efficiency of exploiting the energy in food waste depends on the source of energy the food waste is replacing.

