



Sustainable Renewable Communities



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The QUESTOR Centre

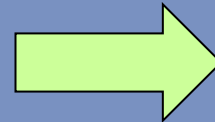


Industry-Driven Cooperative Research Network for:
multi-discipline
environmental research

*Basic
Research*



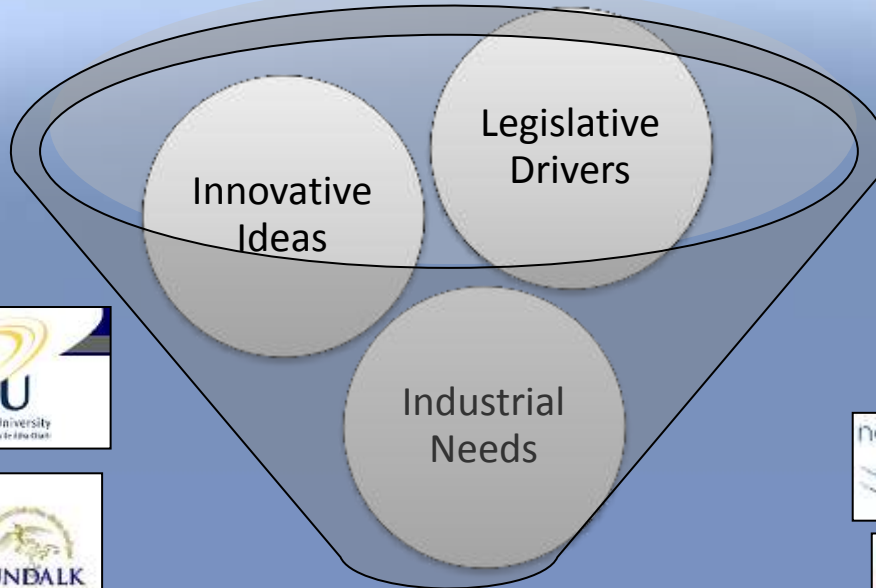
*Applied
Research*



Commercialisation

*Established in 1989 at the Queen's University of Belfast
International Network since 2005*

Partners & Members



Biorenewables in Agriculture



- US State Dept funded visit to Boston and IOWA
- 5-15th February 2013
- Cross sector group
- Policy development



Lincolnway Energy

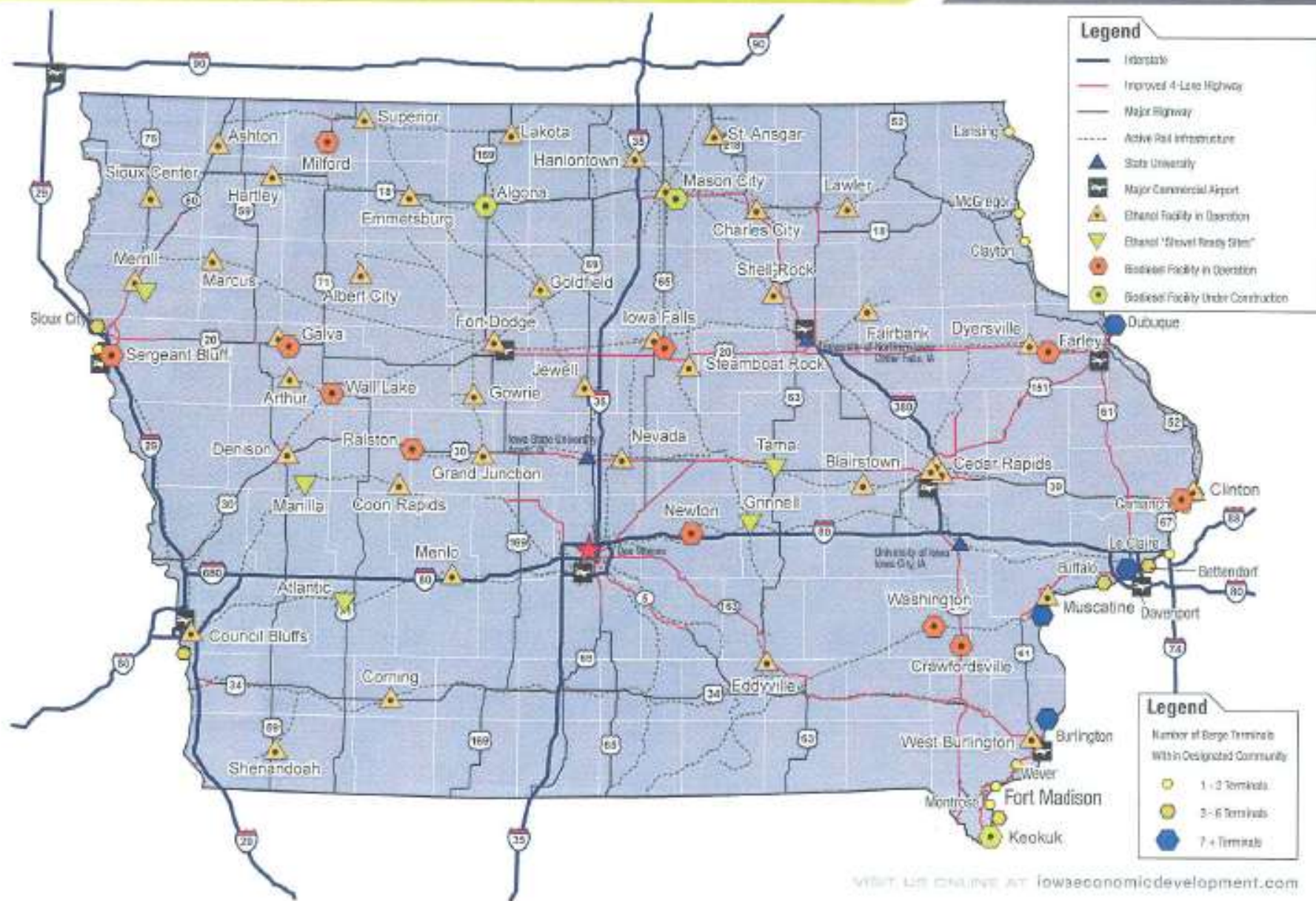


- Corn ethanol plant
- Corn (maize) from 35-40 mile radius (1,396,000 kg/day)
- Products: Ethanol 33%, DDGS 33%, CO₂ 33%
- 50 million gallons ethanol per year
- 900 investors from local community
- Employs 46 people



Scale of production



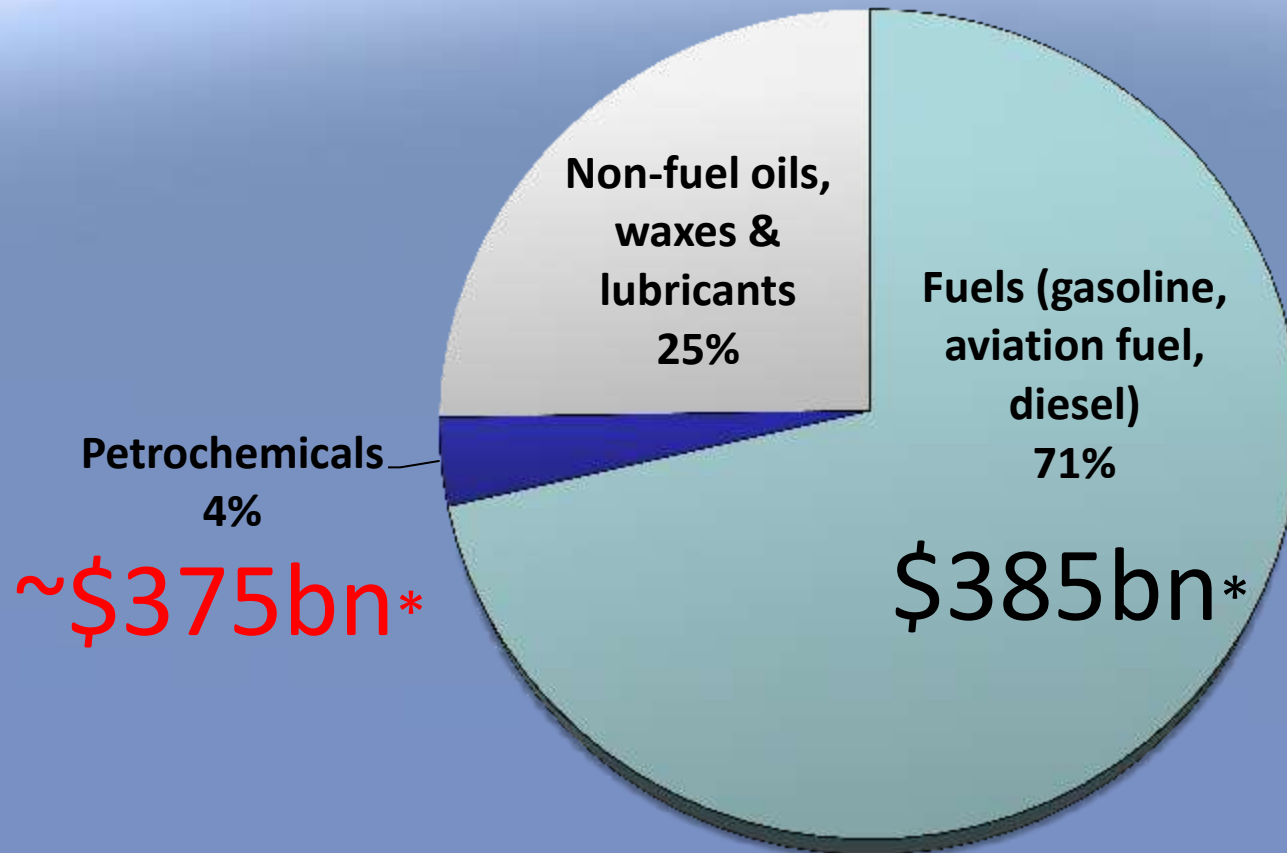


Corn ethanol in Iowa - lessons



- National driver is 'Energy Security' – displacement of imports and balance of trade
- “Do what you are good at” (EU: Smart Specialisation)
- Use existing infrastructure
- Farming viable and profitable again
 - 2002: corn selling \$2.00/bushel; cost \$2.50 to produce
- Invigorated rural economy
- Marginal 'food vs fuel' impact
- But ethanol is 'only the beginning'!

Breakdown of Oil Production



*Pre-tax value. Data: US Dept of Energy 2005

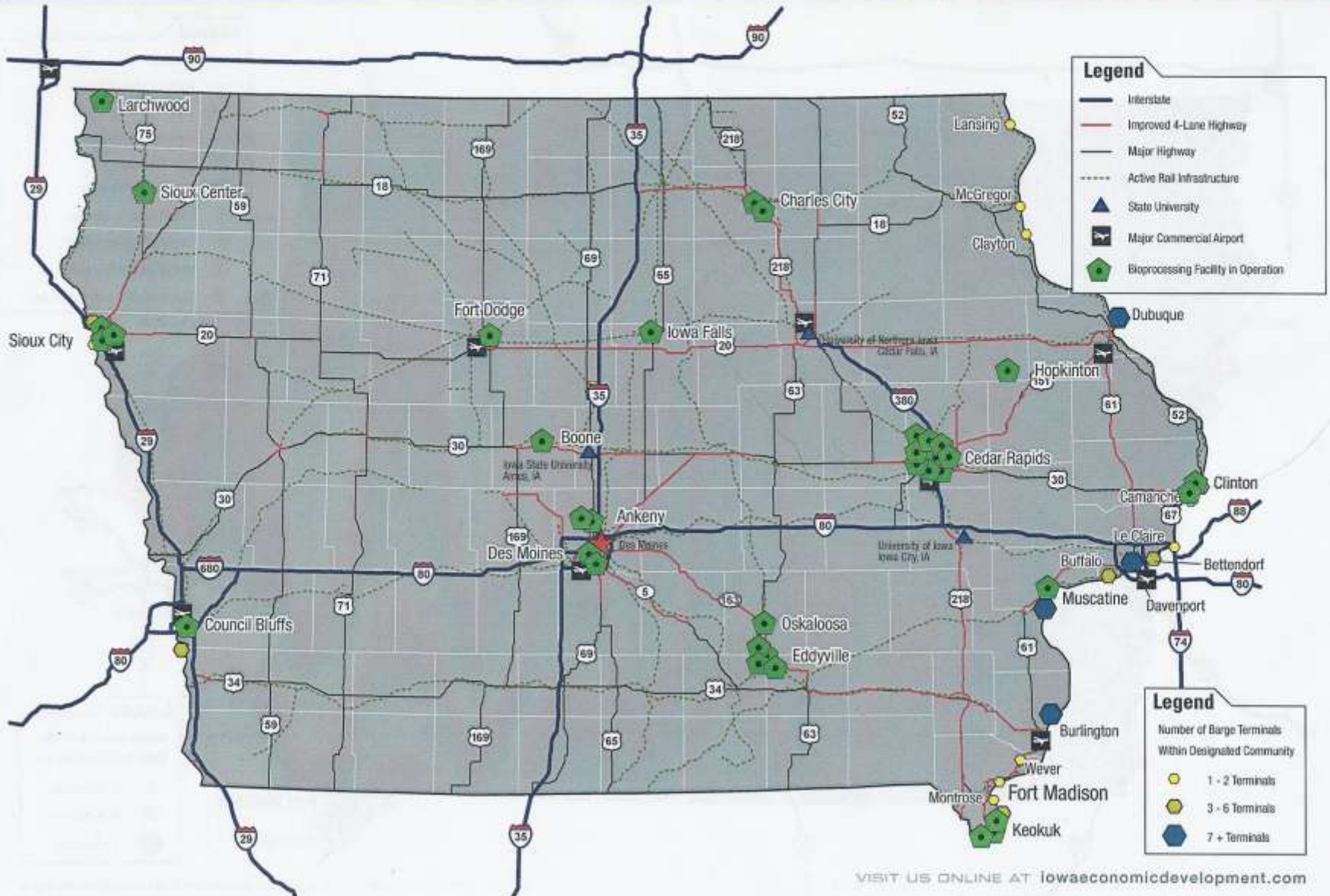
state of iowa industrial bioprocessing infrastructure

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Vision for Ireland

- ✓ National drivers
- ✓ Do what we're good at
- ✓ Use existing infrastructure
- ✓ Make farming profitable again
- ✓ Reinvigorate the rural economy
- Harvest 2020 Food vs Fuel impact



GreenGrass Project (2007-2012)



“GreenGrass: Developing grass for sustainable renewable energy and value added products”

- What is the best grass for energy? (Teagasc)
- Evaluation of digester designs at pilot scale (UCC)
- Quantification of biogas yields and evaluation of pretreatments (QUB)
- Optimisation of entire system – what is ‘best strategy’ in Ireland?



Methane yield (m³/t VS)



Silage type	Europe*	Ireland	Comments
Maize (whole crop)	205-450	303	KTP
Grass	298-467	347	KTP
		355-419†	70ml tests
		483-493†	1.5L tests
		341-451	pilot scale (results from UCC)
Sorghum	295-372	353	KTP

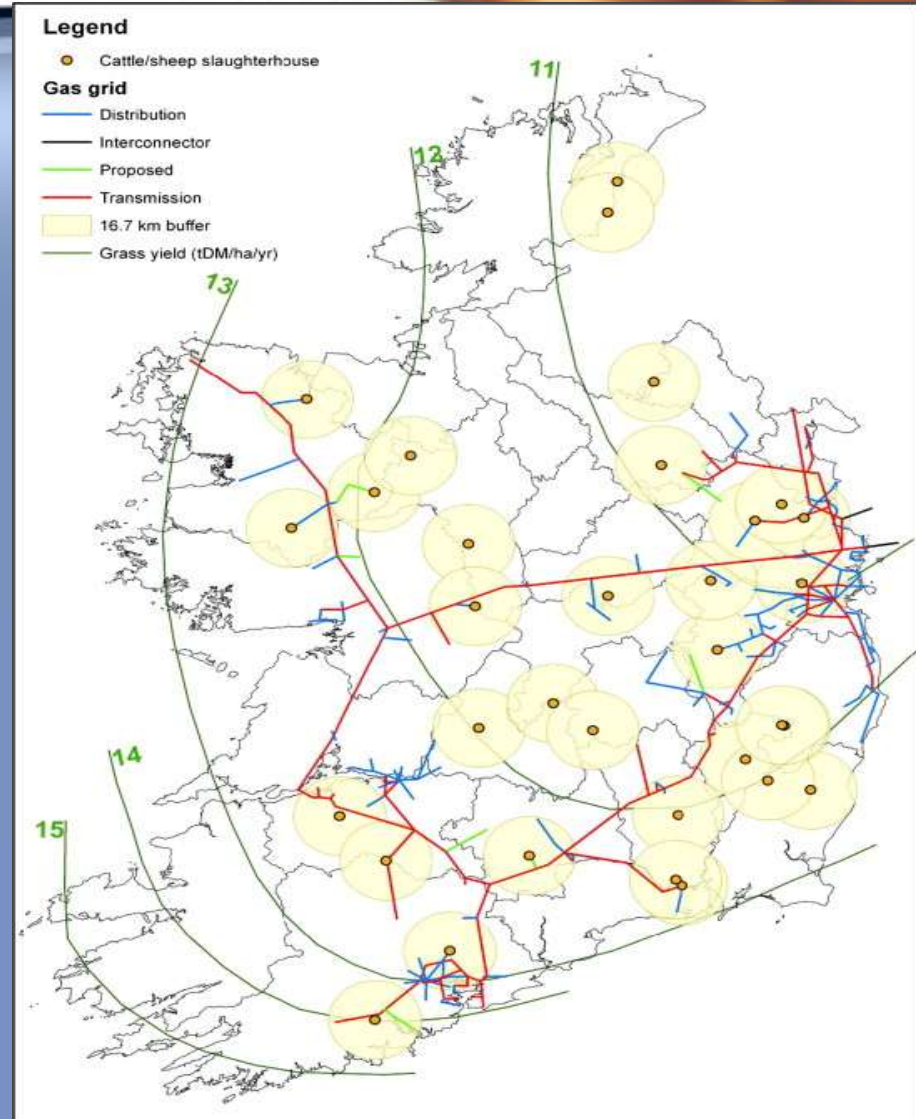
†Perennial rye grass – most consistent and best yield

*Braun et al (2009) *Biogas from energy crop digestion* IEA Task 37

KTP: Knowledge Transfer Partnership with Kedco/AgriAD on biomass feedstock for digestion

Use Existing Infrastructure

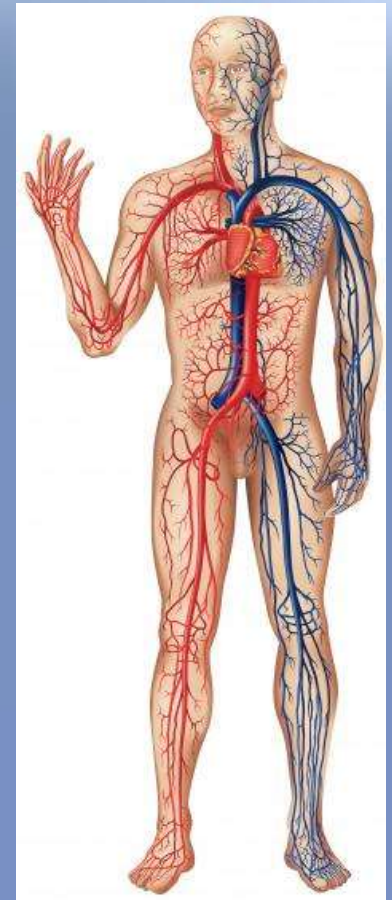
- Grass yields, gas grid and slaughterhouse locations.
- From:
Beatrice M. Smyth , Henry Smyth , Jerry D. Murphy (2011)
Determining the regional potential for a grass biomethane industry *Applied Energy* Volume 88, 2037 - 2049



Centralised and Decentralised Systems



- Transport
- Communications
- Food Delivery
- Waste Collection
- Waste Treatment
- Energy Generation



Focus on Resources & Next Generation Technologies

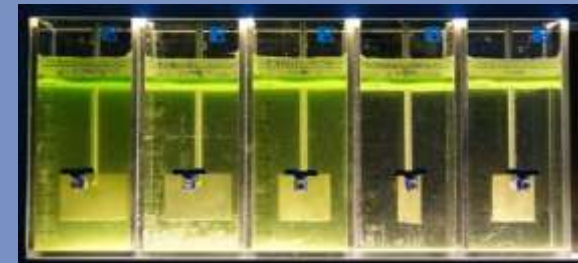


- Resources - what else have we got?
 - Low value agricultural ~~wastes~~ resources; food and other ~~wastes~~ resources; sewage
- How locally can we use these sustainably?
 - Economies of scale, transport distances, energy use/production
- What technologies are coming (or will be needed)?
 - Energy neutral (or energy positive) sewage treatment (with nutrient recovery)
 - Microgeneration
 - Small scale speciality biorefineries

- Alternative techniques for nutrient removal and integration into low carbon future wastewater treatment plants
- Integrated process for biogas production from algal biomass
- Delivering low carbon anaerobic wastewater treatment and renewable energy production

Future:

- Direct energy production – Fuel Cells





Thank you for your attention