Transforming Ireland

Mobilising Innovation and Enterprise to Become a Prosperous Low Carbon Society

Harnessing the Energy Within

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UCD Earth Sciences Institute

with TCD TrinityHaus

In conjunction with the TCD-UCD Innovation Alliance Public Lecture Series

Kedco Plc

Provide platforms to harness to energy within organic feedstocks

Using Gasification and Anaerobic Digestion

The Competence Centre for Biorefinery and Bioenergy

Developed by EI, IDA and Industry Partners

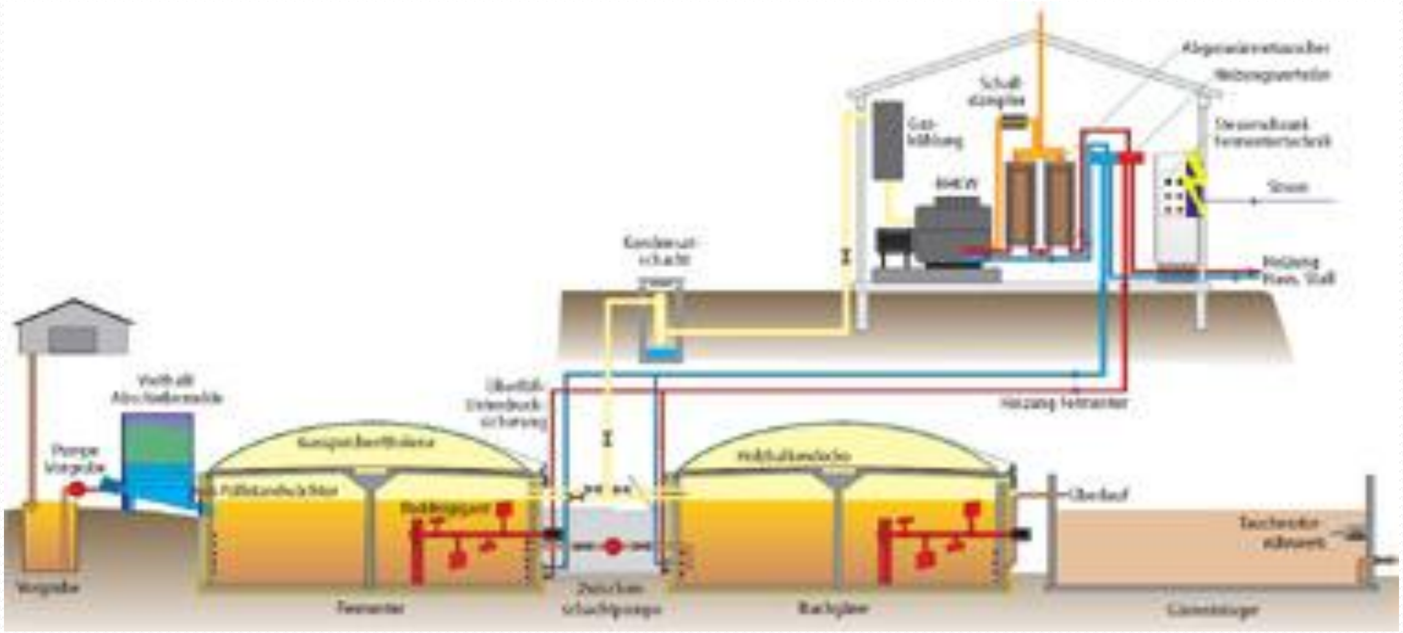
The **Vision** of the Bioenergy and Biorefinery Competence Centre is to provide cutting edge research and development outputs to support a sustainable and competitive Irish biomass (bioenergy and bioproducts) industry

Irish Photovoltaic Cells

Evolved in Ireland
For Ireland

Biogas Plant

Biogas plant

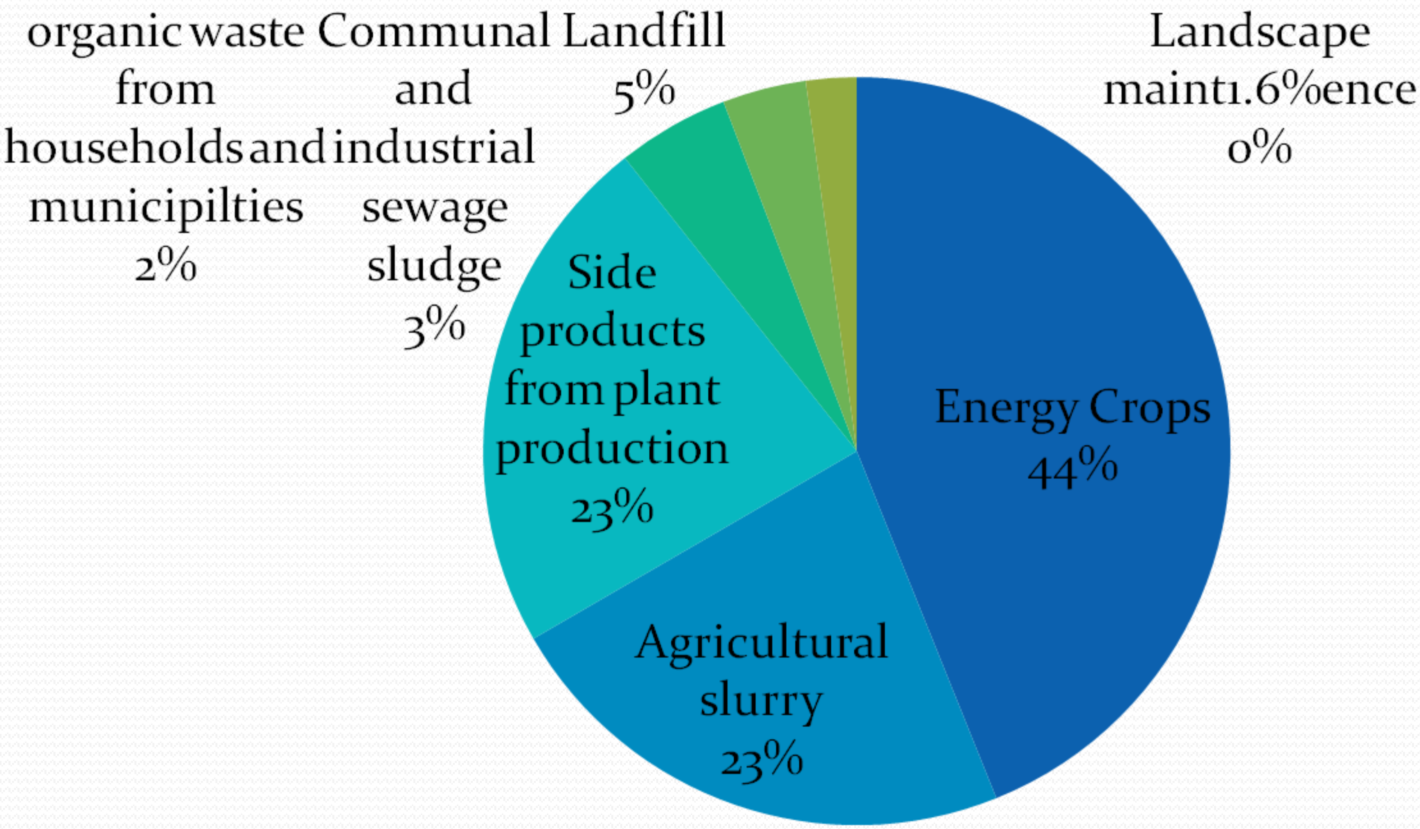


Potentials of Biogas Technology

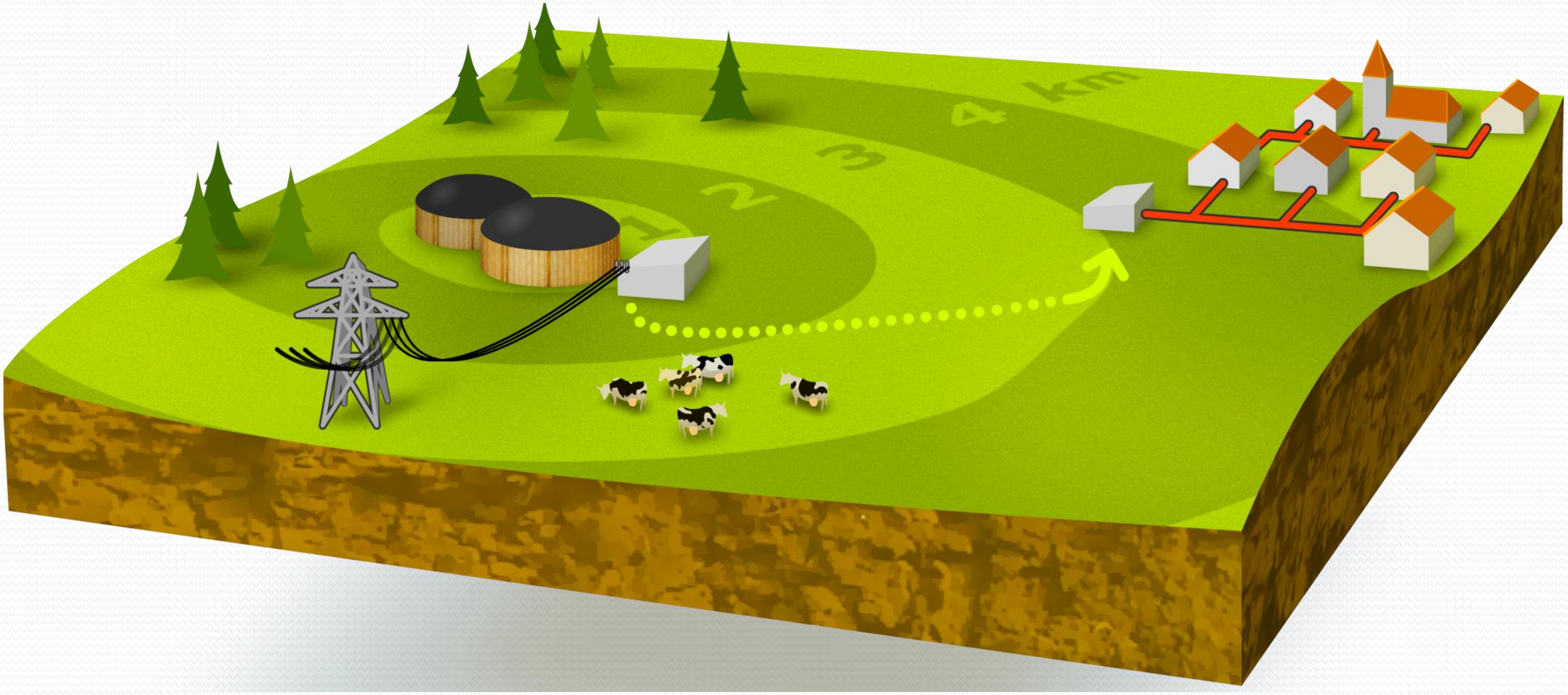
Biomethane is

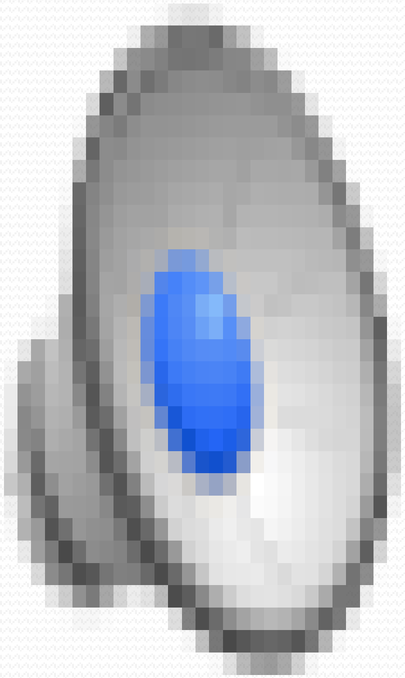
like natural gas – but home produced
like natural gas - but supply secure
like natural gas - but permanently economicial

Biogas potential



Heat Utilisation options through gas pipelines





Lessons from Germany regarding heat losses

- The degree of utilization of residual heat generated in power production at the CHP, may significantly impact the profitability of a biogas plant.
- About 90 percent of all biogas plants are more than 4 kilometers away from large potential heat consumers, such as residential houses, companies, swimming pools, schools, kindergartens and churches.
- Plants should be established where possible as close to potential customers to reduce heat loss in transportation. The further distance, the larger the heat loss. It is not economically viable to relocate CHP units or heating pipes in the vast majority of cases in Germany.

Lessons learned from Germany

- In establishing Biogas Plants proper consideration should be given to the location of the CHP so that the heat created in electricity generation can actually be used. The transport of biogas is cheap and the energy loss in transportation is minimal.
- The advantages at a glance:
  - Cost savings through installation of local heating rather than gas pipelines
  - Minimize heat loss
  - Increase the overall efficiency of the biogas plant
  - But with the waste heat from CHP's one with 150 kW el capacity 130,000 liters of heating oil could be saved per year!

Feedstock flexibility for Biogas plants

Organic waste

Old bread
Apple pulp
Brewers grain
Bio waste
Separation fat
Flotation fat
Vegetable waste
Grain cleanings
Distillery grains
Glycerin
Coffee draff
Coco shells
Potatoe greens
Potatoe peelings
Leaves
Molasses
Wey
Rapeseed cake
Grass cuttings
Onion peelings

Energy Crops

Grass silage
grass silage
Fodder beet
Triticale
WheatPotatoes
Clover
Barley
Sugar beet
Maize silage
Sunflower silage

Biogas yields from different substrates

	Gas yield m3N biogas /t substrate
Cow manure (9% DM)	30
Pig manure (7% DM)	30
Chicken manure (15%DM)	58
Grass silage (25%DM)	151
Maize silage (30%DM)	200
Cereal straw	300
Wheat whole grain (85%DM)	700

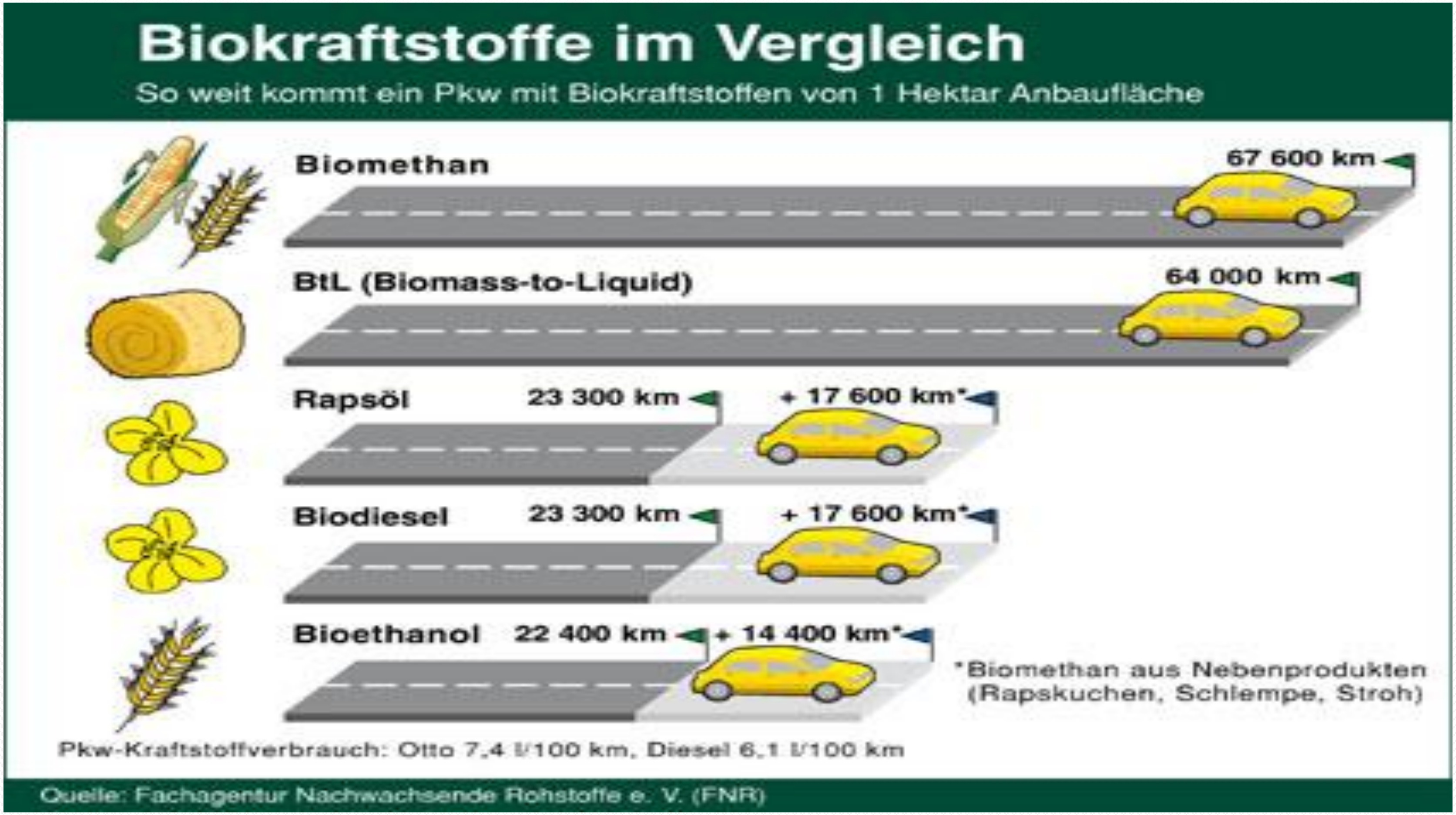
Potential Future Developments

Increased efficiency through digestive ehancers and enzymes

Biorefining of Digestate

- Bioplastics
- Nutraceutials
- Nutritional products

Biofuels in Comparison



Examples of feed in tariff in Europe

Country	Price for biogas €per kw
United kingdom	€0.18
Germany	€0.18- 0.28
Austria	€0.16-0.18
Italy	€0.22-0.28
France	€0.16 (30% capital grant)
Latvia	€0.15- 0.20 (linked to gas price)
Czeq republic	€0.16- €0.18
Ireland	€0.12
Spain	€0.14- €0.16

DEFRA vision for AD

Anaerobic Digestion – Shared Goals

What Anaerobic Digestion Could Deliver Nationally

1. By 2020 anaerobic digestion will be an established technology in this country, making a significant and measurable contribution to our climate change and wider environmental objectives. It will produce renewable energy in the form of biogas that will be used locally or injected into the grid for heat and power and for transport fuel. At the same time, it will capture methane emissions from agriculture. It will also divert organic waste, especially food waste, from landfill. The digestate will provide organic fertiliser and soil conditioner for agriculture and land use. Anaerobic digestion and its products will be used in a way that is both beneficial to the environment and cost effective for that particular location.

This is good news for the environment and for the UK economy

COMPARSION CASE STUDY ON 380KW PLANT

- UK Farmer
- Capital costs €1.3m
- Electricity sales €523,000 uk price €0.18a kw
- Potential heat sales €73,000
- Cost of feedstock
- Grass silage 8000 tonne @€25 €200,000
- Maize silage 1300 tonne @€30 a €39,0000
- Slurry 4000 tonne
- Net profit €169,000

- Irish farmer
- Capital costs €1.3m
- Electricity sales €349,000
- Potential heat sales €73,000
- Cost of feedstock
- Grass silage 8000 tonne @25 €200,000
- Maize silage 1300 tonne@€30 €39,000
- Slurry 4000 tonne
- Loss of €29,000

land use in Ireland

Land area 6.9mha

Agricultural 4.3mha
Forestry 0.7mha
Other 1.9m ha

Pasture ,hay and silage 3.4mha
Rough grazing 0.5mha
Arable crops 0.4mha

91%

The potential in Ireland to produce home grown electricity from grass

- 1 ha of grass land can produce 2.5kw of electricity constantly (90% available)

Example 10% of grassland 3.4mha= 340,000ha x 2.5kw = 850,000kw= 850mw

- The average demand in Ireland for electricity 3080mw
- Grassland alone could produce up 28% of average electricity requirements
- Approx 150ha of grass for approx 0.38mw plant

The potential in Ireland to produce home grown electricity from grass

- A 380kw plant will require feedstock to the value of €240,000 per year. This feedstock must be produced locally.
- 2400 plants would add an extra €576,000,000 to the rural economy per annum.
- Presently the money required to buy the feedstock to generate this amount of electricity is currently leaving the country.

Livestock figures in Ireland

Source national statics

Livestock Figures

	2007	2000
Cattle Numbers	6,572,500	7,037,435
Sheep	5,344,500	6,891,534
Pigs	1,620,100	1,722,108
Horses & Ponies	86,700	69,937
Poultry	11,884,100	13,960,771

Potential electricity produced from cattle slurry

6572,500 cattle Ireland
10 cattle slurry can produce 0.8kw(based on 180 days housed)
Cattle produce 525mw

- The average electricity requirement is 3080kw
- Cattle can produce 17% of Ireland average electricity requirements

The potential electricity produced from pig slurry

The are 1620100 pigs in ireland
100 fattening pigs can produce 2kw
Pig in Ireland can produce 32mw of power

- The average electricity requirement is 3080mw
- Pigs can produce 1% of Ireland requirement

The potential in Ireland to produce electricity from arable land

Total arable crop land 400,000 ha
10% 40,000ha x 2.5kw/ha (sugar beet, maize)
Arable land can produce 100mw

- The average use of electricity in Ireland 3080mw
- Arable land can produce 3.2% of Ireland average electricity needs
- Feedstock costs would (240,000x 263)=€6312000
- This equates to 263(380kw biogas plants)

summary of agricultural potential to produce electricity

- Grassland 850mw
- Arable land 100mw
- Cattle slurry 525mw
- Pigs slurry 32mw
- Total mw potential from agricultural 1507mw
- This equates 49% of average electricity needs

The untapped energy on this island

UCD Earth Sciences Institute with TCD TrinityHaus
Transforming Ireland Seminar Series

In conjunction with the TCD-UCD Innovation Alliance Public Lecture Series

With the support of Business in the Community Ireland and in collaboration with Comhar Sustainable Development Council, Environmental Protection Agency, Geological Survey of Ireland, Sustainable Energy Authority Ireland, Dublin City Council, Met Éireann, Enterprise Ireland, Marine Institute and Teagasc

For Further details on the seminar series is available contact esi.admin@ucd.ie

A podcast of this seminar will be available on the ESI website soon, please join the online ESI mailing list for such notifications