

EXPLORING INDUSTRY INTEGRATION AND SYMBIOSIS

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20 April 2016

Tees Valley Process Industry (TVPI) Study

What

- High level study of process industry (Masterplan)
 - Symbiosis opportunities
 - Opportunities to develop the sector
 - New plants / products

How

- 46 Contributors
- All significant companies
- Dealt with confidentiality issue
- Industry led

When

- Started Oct 2015
- Delivered report April 2016

Contributors To The Study



Study Findings

Short term opportunities - not reliant on obtaining direct government funding:

- Industrial Symbiosis
- Waste Value Enhancement
- Asset, Product Service Maximisation
- Supply and consumption of Surplus Energy
- Purchasing / Operational / Safety / Environmental excellence
- Infrastructure
- Delivering in the short term, resources to :
 - facilitate sharing of information through marketing
 - company brokerage
 - laboratory testing
 - concept and front end engineering support

Medium term opportunities - synergistic link to existing TVPI assets and/or production streams and which could give the TVPI a sustained competitive advantage over other international sites.

Opportunity	Downstream Benefit Potential	Constraint / Mitigation / Action
Acrylic Acid and Acrylates production	<p>Acrylic Acid to Esters for Paints and Coatings</p> <p>Acrylic Acid to Super adsorbent polymer for consumer, plant media medical and (emerging) industrial good</p>	<p>Proprietary technologies from Asia but derivatives markets mentioned have good growth.</p> <p>Needs low cost propylene as feedstock</p>
Acrylonitrile (AN) from PDH or Naphtha	<p>Acrylonitrile to AN Butadiene Styrene Copolymer / Styrene AN</p> <p>Acrylonitrile to Poly AN to Carbon Fibre. Lightweight high strength materials for use in cars, trucks, bridges, aerospace, sports and medical equipment</p>	<p>Unfashionable but derivatives markets mentioned have good growth.</p> <p>Needs propylene as feedstock</p>
Ammonium carbonate and bicarbonate	Local ammonia plus local waste CO ₂ . There are customer blending opportunities	Investor required

Opportunity	Downstream Benefit Potential	Constraint / Mitigation / Action
Animal feed production	Related to previous example. There are existing and potential resources within TVPI, e.g. minerals and bio-based	Mostly small size but high value trace materials plus some general bio-waste beneficiation
Cellulosic ethanol (CE), Bio-based materials and Sugars e.g. Citral and Dibasic Acids	Historically sugar based chemistry for ethanol but CE is more attractive for making green ethylene. Niche demand exists today and will grow Sugars can provide specialities and many intermediates e.g. FDCA as a PTA replacement	Major long term technical issues remain. Some progress from Scandinavian and Italian innovators.
Chloralkali e.g. NaOH + Cl₂ + H₂ (pure) KOH + Cl₂ + H₂	An enabler for Chlorine derivatives e.g. TiO ₂ and other minerals; shale via HCl; esterification of biomaterial. Chlorinated isocyanurates option. Target KOH rather than NaOH	Sustainability and safety enhanced by avoiding Chlorine shipment for water treatment - Trans Pennines
Coal chemistry	Pitch feedstock is basis to make advanced specialty high value materials to be converted locally e.g. Pitch carbon fibre, specialist phenols. Large global speciality materials company has wider for plans Coal to Ethanol for refinery mandate.	Intellectual Property (IP) innovation and ownership Affordable power is an enabler. Optimisation studies required
Ethylene specialities •EO derivatives •Linear Alpha Olefins •Alpha MMA	Provides basis for revival of fine chemical using EO as a building block. Several ethylene LAO technologies available. MMA via ethylene - many downstream markets	Commit to ethylene cracker expansion. Active lobby programme
Fertiliser - Blending and Exports	Expand on the Mineral base with cheap local power to build unique cost competitive business	Real advantages over Rotterdam & Antwerp need to be publicised

Opportunity	Downstream Benefit Potential	Constraint / Mitigation / Action
Mineral Beneficiation	As with fertiliser, real local resources mean this is a strategic opportunity.	Build on existing project which are largely based on non-UK firms. Needs UK Plc approach
Post-consumer waste beneficiation	Numerous TVPI chemistries based in Innovation Parks and local know-how for fillers for rubbers and plastics	IP innovation and ownership Affordable power is an enabler. Optimisation studies required
Poly-tunnel and Algal Pool Uses for CO₂	Land availability, CO ₂ (and H ₂) plus waste heat to make highly effective plant growth media.	Studies ongoing IP innovation and ownership Build on sugar to biochemical knowhow.
Special salts e.g. MgCl₂ to Mg metal from Seawater	Historically magnesium and aluminium production was within TVPI (Alcan in Lynemouth) but no longer, predominantly due to high power costs. Lithium and magnesium are used in the production of light-weighting in cars, plus aerospace and interruptible power.	Power resources are required for long term solutions. Derivatives markets mentioned have good growth.
Surface chemistry	EU Framework Programme (F8) based innovation e.g. graphene and PVD (Physical Vapour Deposition) and CVD (Chemical Vapour Deposition) services	Lack of entrepreneurial spirit in University portion of F8 participants
Waste Stream Recovery from Industry – Multiple Options	There are existing immediate opportunities from the survey and potential new concepts, e.g. Scandium and other rare earth elements from TiO ₂ and fuel ash mining	Mostly small size but early returns. Plus with innovation funding some high value metals and some general plastics valorisation prospects

Long term opportunities - require investment in new technologies, proof of concept or pilot scale testing

- Unconventional Gas as a feedstock for low carbon process industry and manufacturing growth
 - Access to local feedstock and affordable energy are the biggest differentiators in establishing a sustainable process, chemical and manufacturing sector
 - Growth in US Chemical sector
 - Low carbon potential
 - Massive resource

2 Months on

- Study widely praised by various stakeholders
 - BIS
 - UKTI
 - CGP
- Recommendations built into LEP bid to Growth Fund
- Several symbiotic opportunities being developed
- Desire from other process industry clusters to complete a similar study