

Facilitated Industrial Symbiosis

A Pillar for UK Industrial Strategy
RRfW Annual Conference
Leeds 1-2 December 2016

Peter Laybourn
Chief Executive
International Synergies Limited



1. General update on industrial symbiosis
2. Reminder of past performance & future potential
3. Sir Mark Walport Annual Report (2017)
4. Rationale behind industrial symbiosis supporting an Industrial Strategy

“Striving to lead the world in
innovative industrial ecology solutions
for a low carbon, sustainable economy”

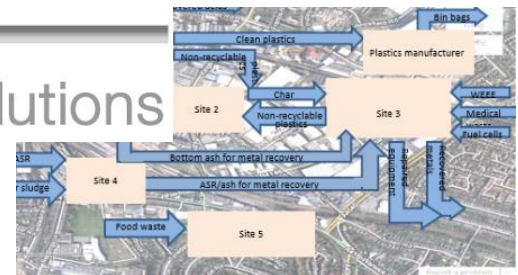


NATIONAL INDUSTRIAL SYMBIOSIS PROGRAMME

SYNERGie®

Industrial Symbiosis Limited

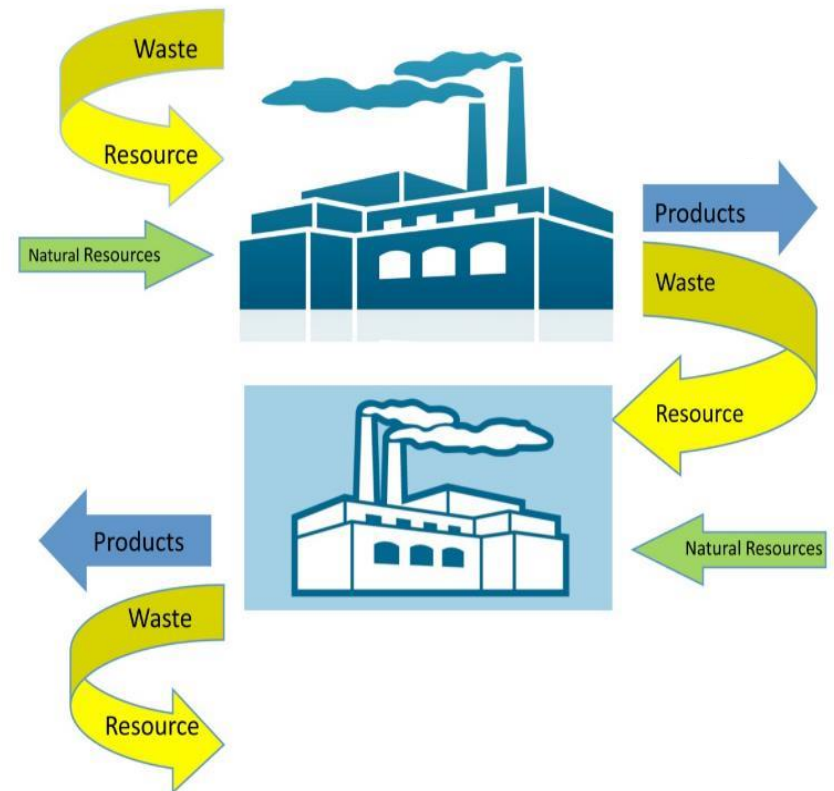
advancing industrial ecology solutions



| Industrial symbiosis: connecting industry, creating opportunity

International Synergies
industrial ecology solutions

- Network of diverse organisations for **cross-sector business opportunities**
- All **resources** (materials, capacity, expertise & energy)
- Impact through **profitable transactions** (inputs, outputs, processes)



Lombardi & Laybourn, 2012, Journal of Industrial Ecology 16(1):28-37

- Resource efficiency
- Demand-led innovation
- SME engagement
- Landfill diversion
- Water savings
- Carbon emissions reduction
- Virgin material savings
- Jobs
- Cascading of best practice
- Increased sales & reduced costs
- Profits leading to tax revenues



Profit

Competitiveness

Cost

Jobs

Risk

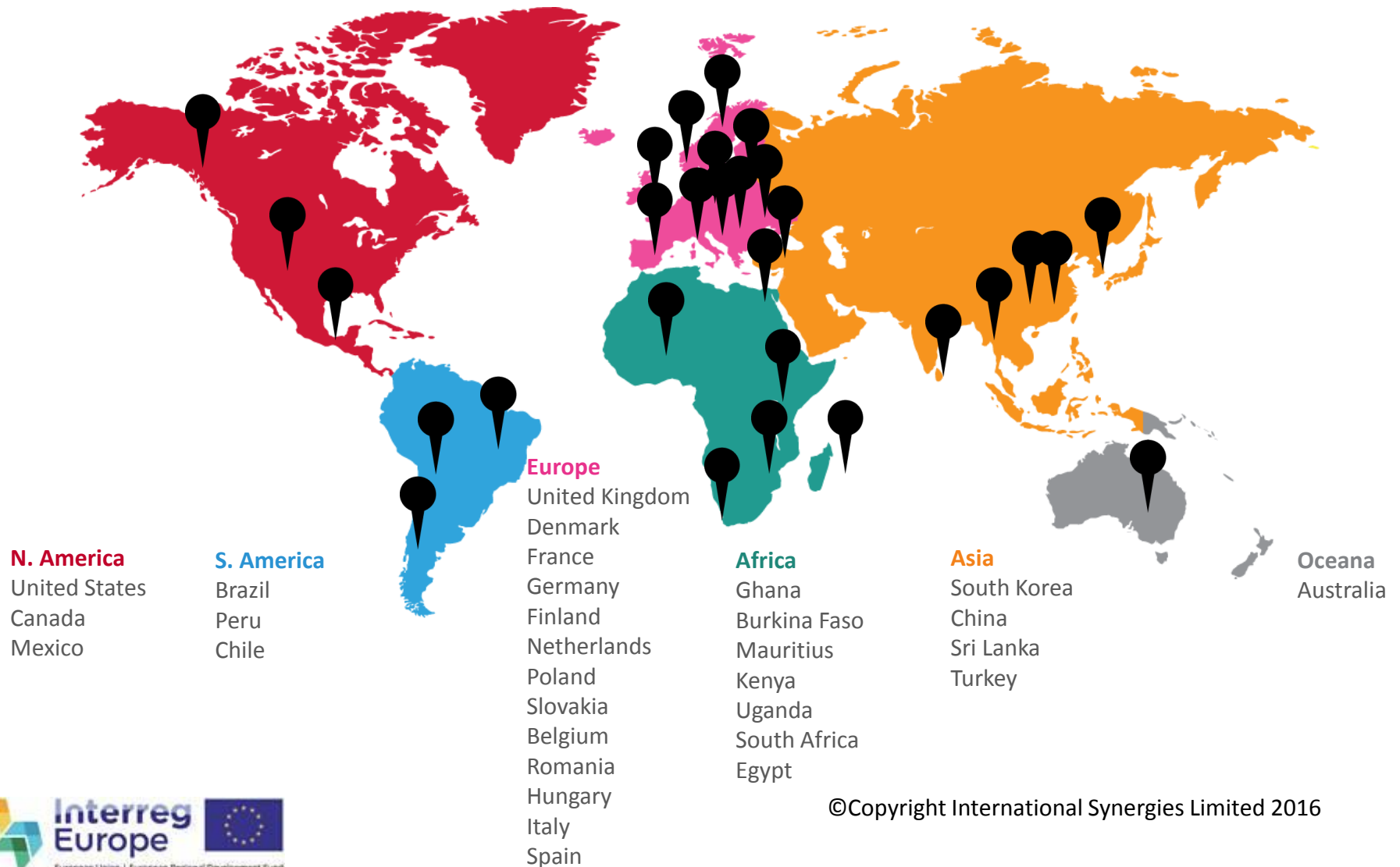
Growth

For Business

For Economies

| Our global experience

International Synergies
industrial ecology solutions



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| Proven approach

International Synergies
industrial ecology solutions

Workshop in Bretagne, Quimper March 2016

Programme National de Synergies Inter-Exchanges (PNSI)





WISP
Western Cape Industrial
Symbiosis Programme

Business Opportunity Workshop River Club, 28 September 2016

This is a summary of the Business Opportunity Workshop that took place on Wednesday, 28 September 2016 in which **44 companies** were represented. Delegates identified new business opportunities from under-utilised resources through the application of industrial symbiosis (IS) principles. A total of **257 resources** were discussed on the day and **1025 potential synergies** identified.

First, and foremost, WISP would like to thank all the delegates who participated in this successful workshop. WISP would also like to thank the following speakers: Anzel Venter (WCG: DEADT), Eddie Hanekom (WCG: DEADP), Lauren Basson (GreenCape), Khanyiselo Kumalo (GreenCape) and Andre Page (National Cleaner Production Centre). Special thanks to Liesel Olivier from AgriProtein for sharing how WISP has assisted them growing their business, and in so doing, facilitating the idea of IS.

Who Was There:

7 Seas Plating	Groceries Unlimited	Rubble Cycle
AgriProtein	Jaigh Outsourcing	Select a Fish
Alnet	Jinko Solar	Snoek Wholesalers
Blue Planet Energy	Kimberly Clark SA	Stuttafords
BM Foods	Nampak: Bevcan	Syntell
CCS Logistics	National Glass	Tafelberg Furnishers
Checkers	New Horizons Energy	Tellumat
Combo Timbers	NGK Ceramics	Tramco
Coricraft	Peninsula Beverage Plain	UCT
CSK Material	Fin	Victory Fine Foods
Deli Spices	Plastoil	WastePlan
Distell (Epping)	Polyplank	ZTL Organics
Evedently Green	Reclite	Shereton
Forest Creations	Recycle 1st	Shredmaster
Fruit & Veg City	Romatex	



What Did You Think WISP Could Achieve?

Boost Sales:	3.3 / 5
Reduce Costs:	4.4 / 5
Stimulate Innovation:	4.0 / 5
Promote Learning:	4.7 / 5
Reduce the Use of Virgin Material	3.6 / 5
Reduce Green House Gas Emissions	3.7 / 5

What You Thought About the WISP Workshop?

Meeting Your Expectations:	4.5 / 5
Networking Opportunities:	4.5 / 5



"IS is possibly one of the most underrated areas for the growth of SME's and job creation"

— Desmond Deary (ComboTimbers)

"An eye opener as to how other's waste / by-products can be utilised by other companies"

— John Metcalfe (National Glass Distribution)

What NEXT:

wisp@green-cape.co.za 021 811 0250

1. Check your matches
2. Start discussions to progress matches
3. Contact WISP for support
4. Keep in touch about progress
5. WISP will also be in touch to see how it's going

Success stories

International Synergies industrial ecology solutions

Thousands of case studies (synergies)

Case Study www.nisp.org.uk

Fab savings met in the UK for Michelin

Organisations involved: Michelin, Waste End Strategy (WES)

The Challenge
Michelin manufactures and sells tyres for all kinds of vehicles, publishes maps and guides and operates a number of digital services in more than 135 countries. For Michelin, Salford, which celebrates its 40th anniversary in 2005, the disposal of Michelin, the metallic reinforcing with its own unique rubber used in heavyweight tyres, was increasing overall production costs and also needed to be diverted from landfill to achieve local environmental targets set by the Salford City Council. WES is currently testing additional outlets with spare capacity to process the output from another Michelin plant in Dunstable and later in the year the French plants. The diversion from landfill, of Michelin, to satisfy stringent local targets at the Michelin Salford plant was a solution achieved by Waste End Strategy with the end results documented below.

The Solution
Management at the Salford plant needed to source an alternative disposal route to achieve their landfill diversion targets. Michelin, owing to its unique nature and structure, requires specialist outlets to recover the steel content and the rubber. Waste End Strategy sought to maximise the cost effectiveness of an alternative outlet for the Michelin and saw the NISP methodology as a means of providing a sustainable solution. Through collaboration with an established partnership, WES was able to provide a different outlet for the Michelin in London and now also in Cardiff. This represents a two phased solution that helps divert the material from landfill to a number of outlets for the Salford City. WES is currently testing additional outlets with spare capacity to process the output from another Michelin plant in Dunstable and later in the year the French plants. The diversion from landfill, of Michelin, to satisfy stringent local targets at the Michelin Salford plant was a solution achieved by Waste End Strategy with the end results documented below.

The Results

- Additional Sales: £54,891
- Businesses Assisted: 4
- CO2 Reduction: 381 T
- Training Outcomes: 4
- Landfill Diversion: 981 T
- Virgin Materials: 501 T

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Or visit www.nisp.org.uk

NISP NATIONAL INDUSTRIAL SYNERGIES PROGRAMME

Case Study www.nisp.org.uk

Befesa, a new home for Waste Foundry Sand

Organisations involved: Befesa Salt Slags Limited, Various Foundries

The Challenge
Through links with the Cast Metal Federation, numerous local foundries contacted NISP West Midlands for assistance in identifying alternative and sustainable ways to reuse spent foundry sand, a waste product of their process. Befesa Salt Slags operate a purpose built facility to treat waste streams produced by the primary secondary and associated aluminium and iron industry sectors. Over the last few years as the capacity of the plant increased the decision was made to look at other waste streams that were being generated within the foundry industries on the basis of offering an alternative to landfill.

The Solution
NISP have facilitated the relationship between Befesa Salt Slags Limited and numerous businesses within the West Midlands region. The Befesa factory was commissioned in 1998 and is recovering on an annual basis 4000 tonnes of aluminium concentrate with a liquid metal yield of 3,300t, then a crystallisation of up to 18000t of salt, which is a mixture of potassium and sodium chloride for reuse within the industry and also as a fertiliser, and the remainder of the metal balance being made up of alumina / aluminium oxide suitable for the aggregate, cement and brick industries. Prior to 1998 the vast majority of these valuable materials were being disposed of to landfill. By way of NISP introducing the businesses to Befesa, deals have been agreed which has resulted in over 10,000 tonnes of material being diverted away from landfill, and into alternative outlets.

The Results

- Additional Sales: £260,000.00
- Businesses Assisted: 4
- CO2 Reduction: 1,920
- Cost Savings: £200,000.00
- Landfill Diversion: 10,000
- Virgin Materials: 10,000

Ben Armer-Smith
Commercial Director, Befesa Salt Slags Limited
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Or visit www.nisp.org.uk

NISP NATIONAL INDUSTRIAL SYNERGIES PROGRAMME

Alternative uses for waste beer.

ORGANISATIONS INVOLVED
Diageo UK Ltd.

SUMMARY
Diageo, one of the world's leading producers of the world famous beer Guinness, as part of the production process this beer undergoes very strict quality control procedures. The result is some waste beer is produced and gets disposed of in a secure manner in Ireland. NISP were asked to examine the viability of using surplus disposal points nearest to the production facility in Farnham, County Wick.

BACKGROUND
Diageo produce this beer and have very keen duty of care procedures that not only have to satisfy the Environment Agency but also HM Customs & Revenue. They take steps to ensure that the beer does not fall into the hands of anyone and therefore protect the quality of their products. As a NISP member, they asked for our help in finding a more financially and environmentally viable option for their liquid waste.

THE NISP CONNECTION
NISP identified key solution providers with the potential to help Diageo in their quest for more financially and environmentally sustainable solutions to the treatment of the beer. The beer went through a strict waste acceptance criteria involving various audits to assess suitability and Diageo performed audits on the solution providers involved to ensure that their security procedures were of the correct standard for the waste to be treated and disposed of properly. As a result, the beer has gone to use ranging from fertilising agricultural land to the provision of power through anaerobic digestion, and Diageo have managed to secure a definite environmental and financial win for the waste beer.

ACHIEVEMENTS

- Reduction in CO2 of 6500 tonnes per year
- Diversion from waste disposal of 2000 tonnes per year

CONTACT DETAILS
Stuart Smith, NISP North West - 07820 801567

NISP NATIONAL INDUSTRIAL SYNERGIES PROGRAMME

SUMMARY
NISP North East is working with members Terra Nitrogen (UK) Limited and John Baxters Ltd in a fruitful collaboration which sees a novel 'leading 38' new greenhouse in Bingleigh growing tomatoes all year round, creating 85 new jobs and diverting 12,000 tonnes of carbon dioxide emissions.

BACKGROUND
Terra Nitrogen is part of Terra Industries Inc, a leading international producer of nitrogen products and materials. Looking for alternative ways to use its by-products, the company teamed up with Humbleton fruit and vegetable grower John Baxters Ltd to provide the infrastructure to supply and deliver nitrate to the 38 acre site.

The £10 million greenhouse, the largest in the UK, will grow over 300,000 tomatoes a year to be sold on to retailers such as Sainsbury's and Asda. The site will use more than 12,000 tonnes of CO₂, a by-product of Terra's nearby manufacturing site, significantly reducing the company's emissions. Since from the plant will be used for the greenhouse, in addition, Terra Nitrogen will supply electricity to the greenhouses, ensuring Baxters benefits from specially agreed low rates, enabling them to produce tomatoes throughout the winter, providing a real boost to British agriculture as tomatoes would normally be imported from Spain during the winter months.

THE NISP CONNECTION

- NISP worked with Terra Nitrogen to identify alternative ways to use by-products of the company's manufacturing plant.
- Terra Nitrogen Regeneration teamed with the two companies, both members of the NISP North East Programme, to ensure the project's feasibility in terms of development of technology and implementation of infrastructure. NISP assisted this process and ensured continued promotion of this symbiotic relationship.

ACHIEVEMENTS

- 85 new jobs created
- Reduction of 2,500 tonnes of CO₂ emissions
- Successful reuse of waste heat
- £10 million private investment in region

CONTACT DETAILS
Dave Smith, National Programme Manager, NISP - 0121 702 4500
Christine Parry, Regional Co-ordinator, NISP North East - 01204 304200

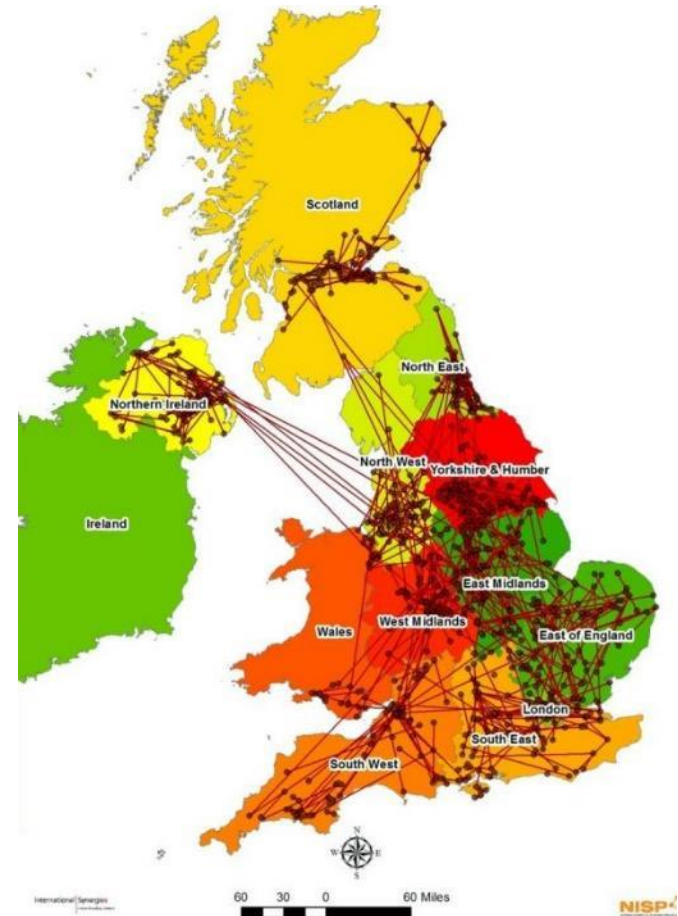
NISP NATIONAL INDUSTRIAL SYNERGIES PROGRAMME

| Defining local: Market determines value

Half of synergies completed within 21 mile radius

One-quarter of synergies involved distances greater than 40 miles radius

Jensen et al (2011) Resources, Conservation and Recycling 55:703-712



England April 2005 – March 2013

METRICS	In Year Benefits*	Lifetime Impact (Max 5 year)
Landfill diversion	9.4 million tonnes	47 million tonnes
CO ₂ reduction	8.4 million tonnes	42 million tonnes
Virgin material savings	12 million tonnes	60 million tonnes
Hazardous waste eliminated	0.4 million tonnes	2.1 million tonnes
Water savings	15 million tonnes	72 million tonnes
Cost savings	€243 million	€1.21 billion
Additional sales	€234 million	€1.17 billion
Jobs	10,000+	
Private investment	€374 million	

**€43.4 million investment - *All outputs
independently verified
Rate of return for Govt. 9:1
Exchange rate £1 = €1.18**

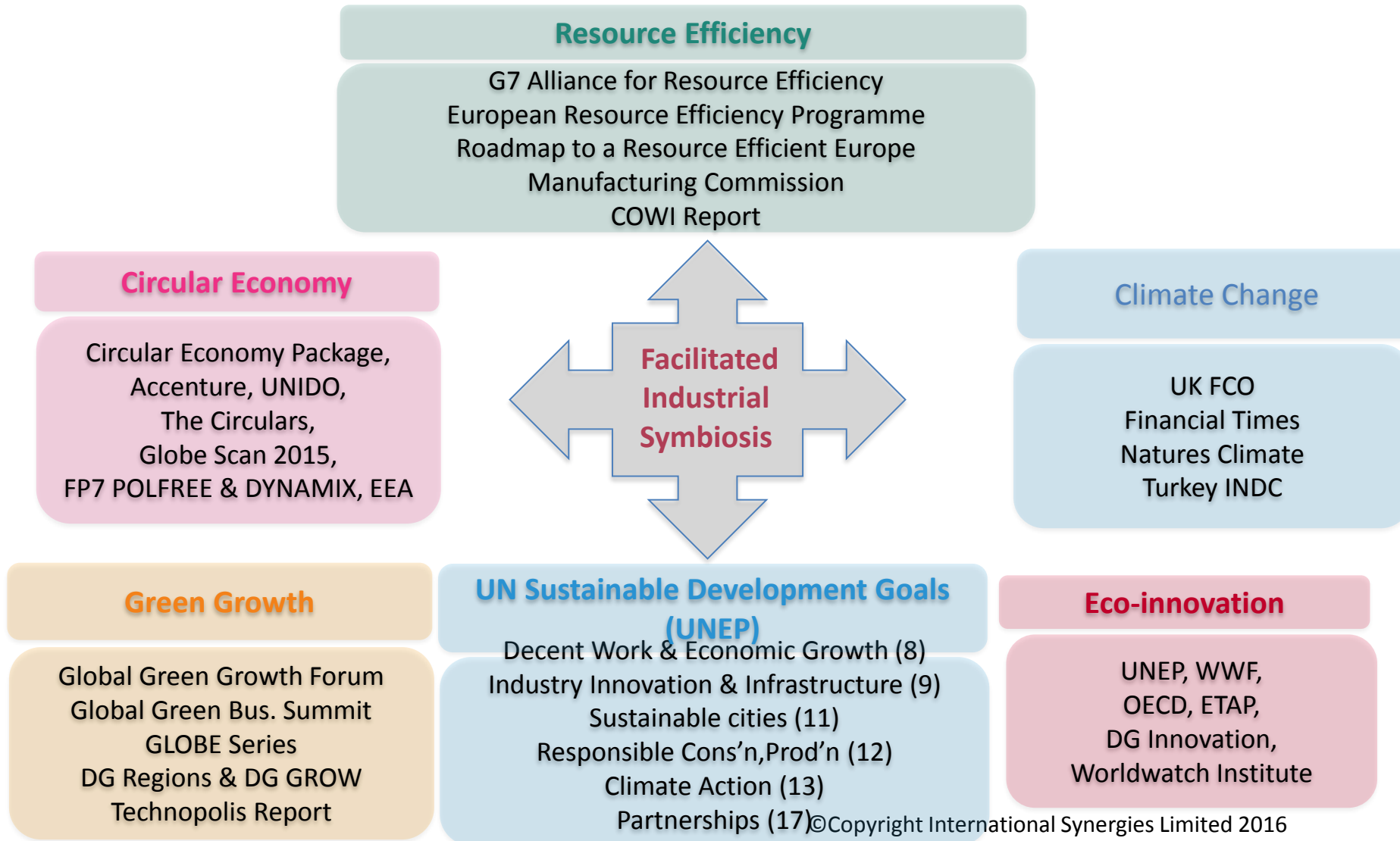
NISP[®] (England) Economic Impact Assessment

Total investment over <u>5</u> years	£27 million
Total Economic Value Added	£1.5 - £2.5 billion
Direct receipts to Government	£148 - £247 million
Benefit Cost Ratio	32:1 to 53 :1

Input Required by NISP April 2005 - March 2010	
Benefit generated through NISP	Actual
£1 new income for industry	2 pence
£1 cost saving for industry	3 pence
1 tonne of virgin material saved	41 pence
1 tonne of water saved	41 pence
1 tonne of CO ₂ reduced	65 pence
1 tonne of waste diverted from landfill	56 pence
1 tonne of hazardous waste eliminated	£10.86
<small>*Scenario 1 - Persistence effect with 20% decay per annum *Scenario 2 - Persistence effect with 0% decay per annum</small>	
<small>The above figures are based on total investment of £27,650,000 between April 2005 and March 2010 and relate to outputs generated in England only.</small>	

NISP Economic Valuation Report
Manchester Economics (2009)

- European Waste Framework Directive (2009)*
- Roadmap to Resource Efficient Europe – exemplar (2011)*
- DG Regions: Connecting Smart and Sustainable Growth through Smart Specialisation – exemplar (2012)*
- DG Enterprise: Communique on Green Entrepreneurship (2013)
- European Resource Efficiency Platform – key recommendation (2014)
- DG Innovation & Research: Short guide to assessing environmental impacts of research and innovation policy (2014)*
- Circular Economy Package (2015)
- EEA, Circular economy in Europe (2016)*
- SPIRE 13 (replication), DG GROW (estimate of market/platforms)





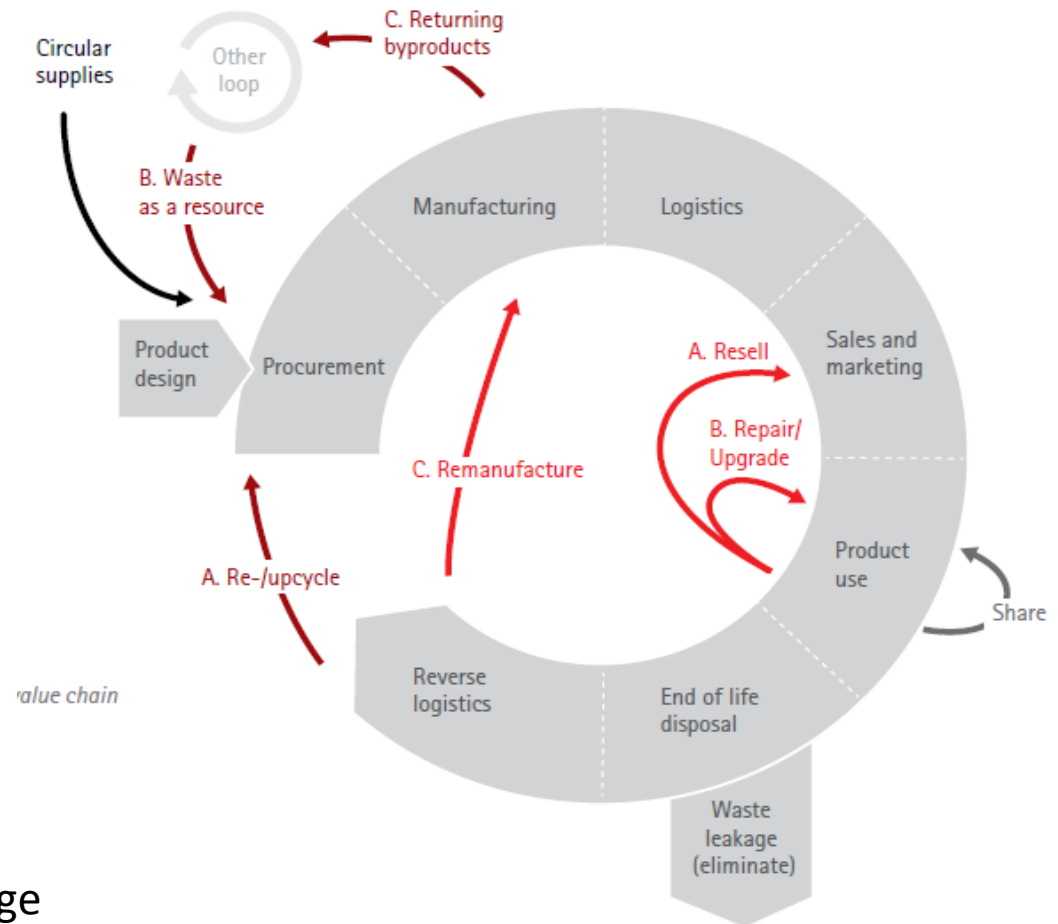
G7 GERMANY

2015 | G7 Alliance for Resource Efficiency

Industrial symbiosis: circular economy in action

International Synergies
industrial ecology solutions

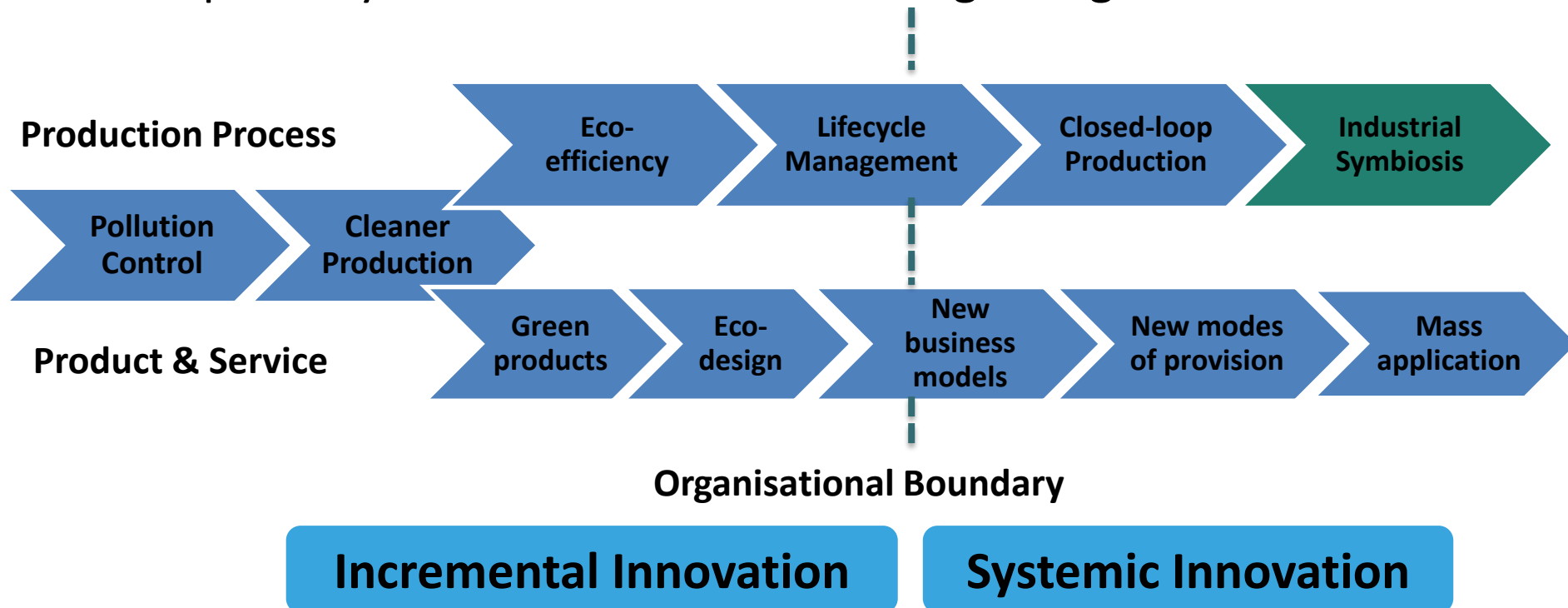
- Circular supplies
- Resource recovery
- Product life extension
- Sharing platforms
- Product as a service



Accenture 2014, Circular Advantage

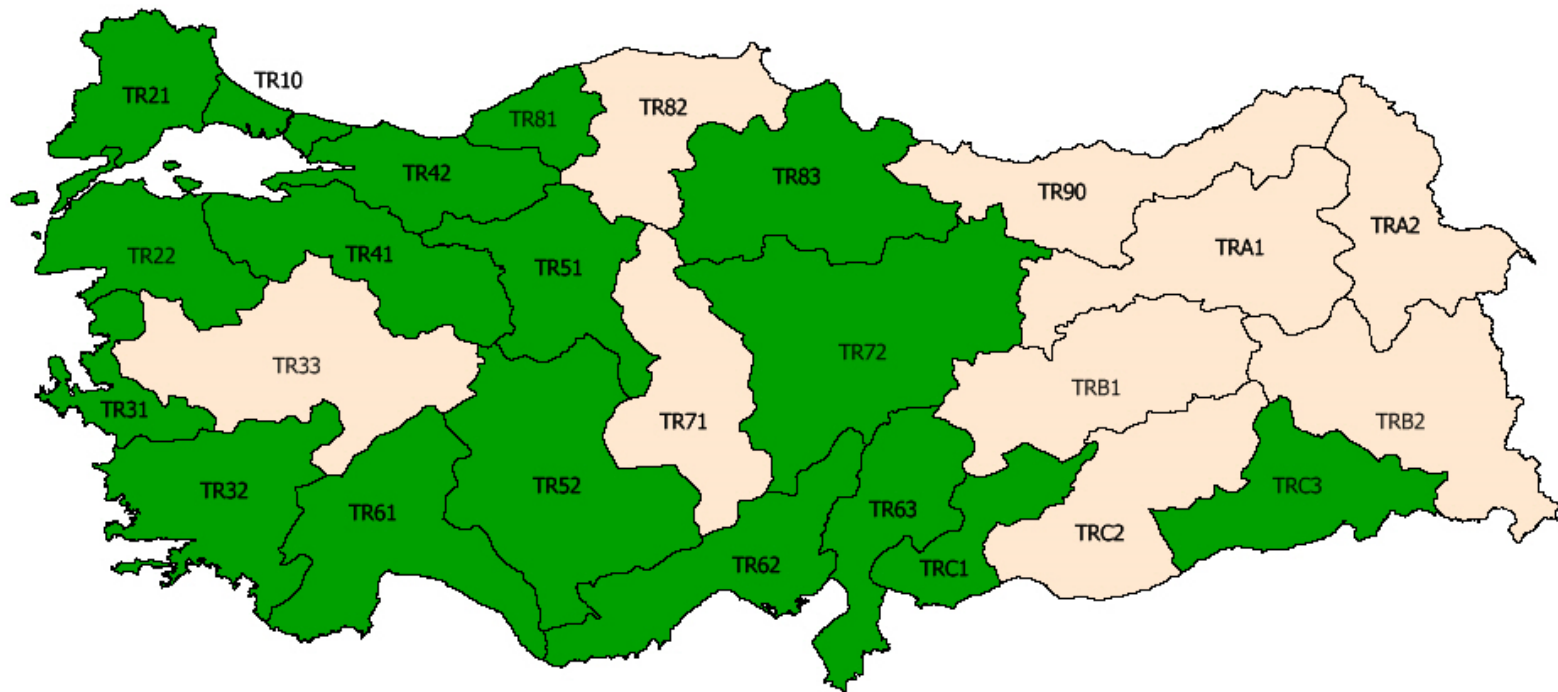
- Circular Advantage, Accenture (2014)
- Globescan 2015 www.govsgocircular.com
 - 30 circular economy best practice examples for governments (two are industrial symbiosis)
 - report co-authored by Accenture, De Groene Zaak, EY, IMSA and Royal Haskoning DHV
- FP7 POLFREE & DYNAMIX 2015 (Top 10 proposals)
- Industrial Evolution, Manufacturing Commission (2015)
- Circular economy in Europe – Developing the Knowledge Base, European Environment Agency (2016)

OECD declared industrial symbiosis 'a la NISP' to be an 'excellent example of systemic innovation vital for green growth'



| Implementation e.g. Turkey, INDC explicit

Regions with industrial symbiosis specific initiatives and strategies



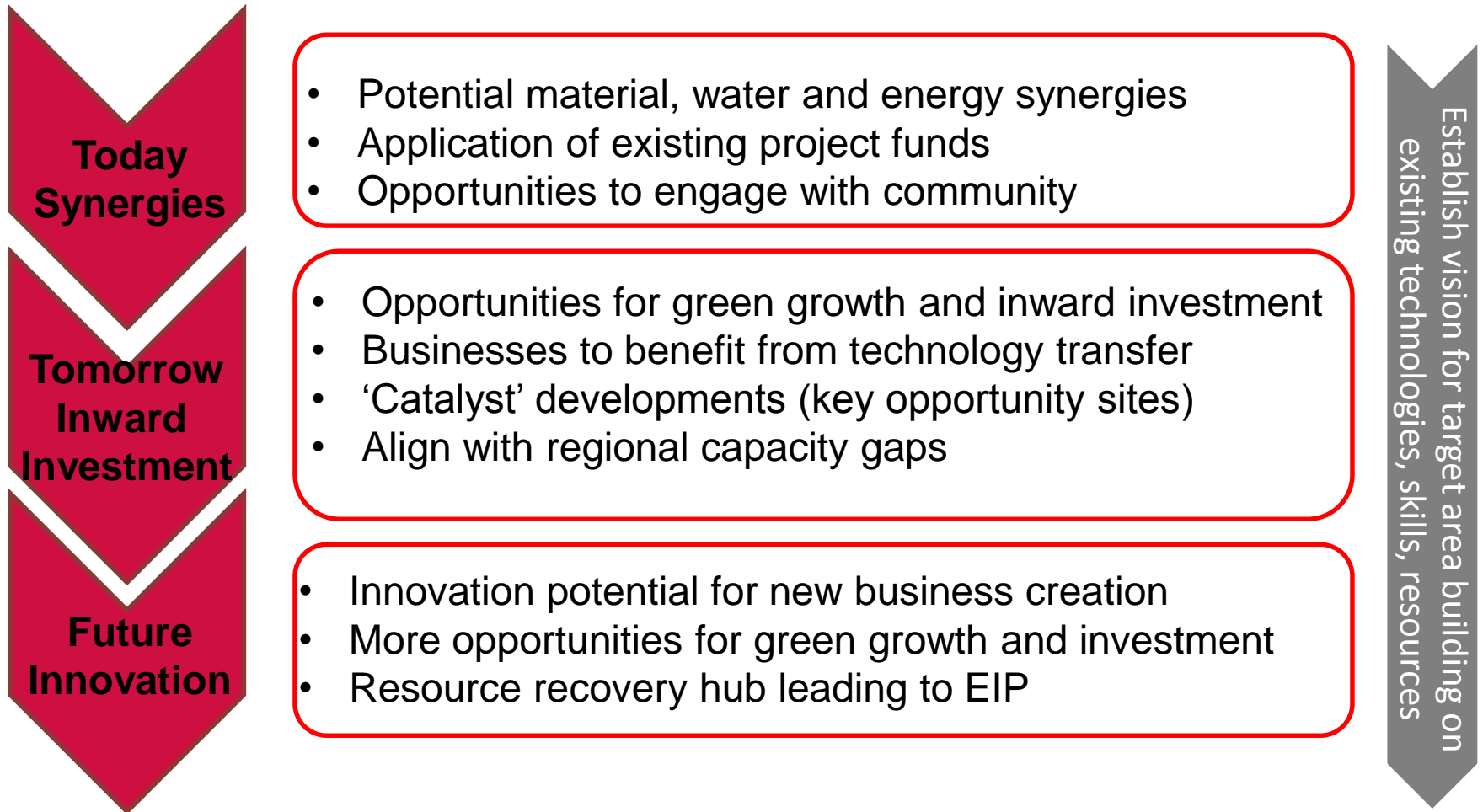
| Steady stream of innovative applications

- Planning and regeneration
- Inward investment
- Construction & utilities (MI-ROG)
- Knowledge transfer
- Post-disaster/post-conflict situations (e.g. Lebanon)
- ASPIRATION – government direct involvement e.g. health, transport, municipalities
- Problem solving

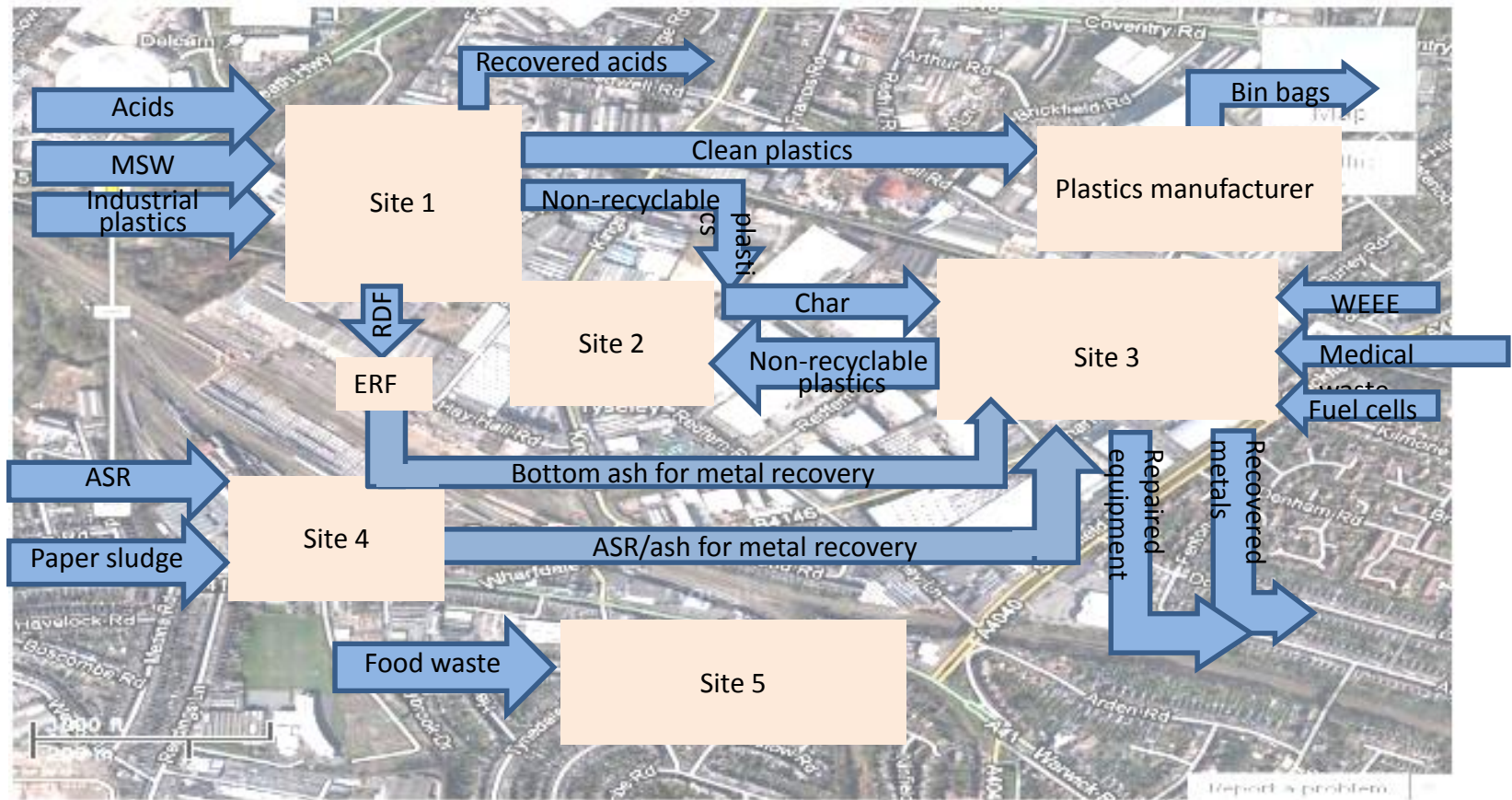


| Urban symbiosis: Opportunities built on existing assets

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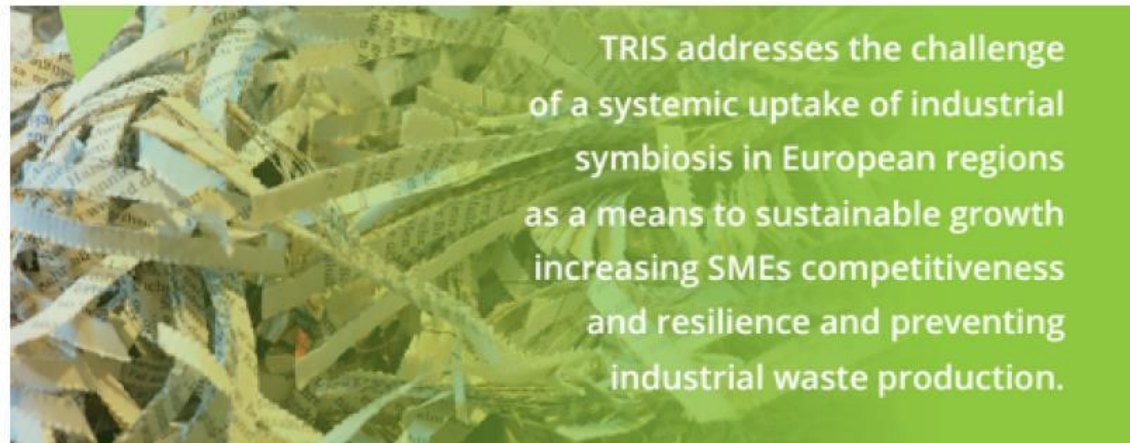


Economic development and regeneration in Birmingham



| TRIS -- Transitioning Regions Toward Industrial Symbiosis

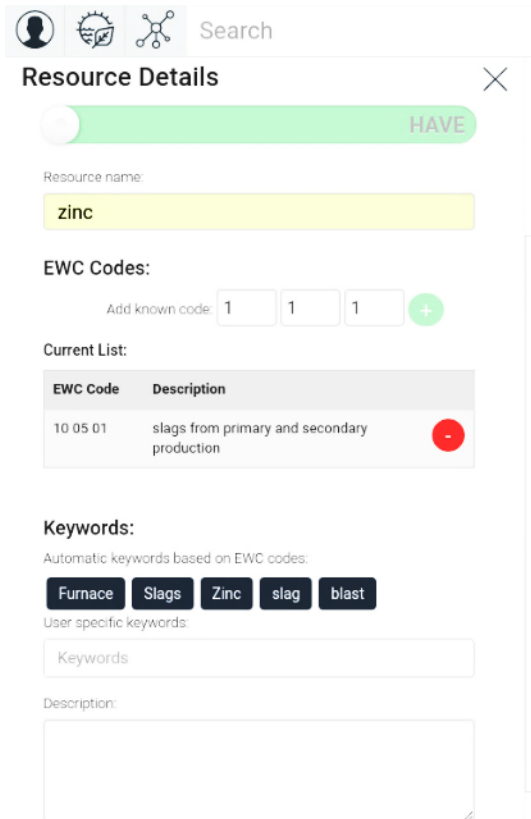
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- Birmingham, UK: Birmingham City Council, Industrial Symbiosis Ltd
- Emilia Romagna, Italy: DG Environment, ASTER
- Central Hungary: IFKA, Herman Otto Institute
- Småland, Sweden: Energy Agency SE
- Valencia, Spain: IVACE, AIDIMME

| SYNERGie® -- *our* Internet of Things

International Synergies
industrial ecology solutions



The screenshot shows the 'Resource Details' window in the SYNERGie platform. At the top, there are icons for user profile, search, and a network diagram, followed by a 'Search' button. Below this is a green progress bar with a 'HAVE' label. The 'Resource name' field contains 'zinc'. Under 'EWC Codes', there are three input boxes each containing '1' and a green '+' button. The 'Current List' section contains a table with one entry: '10 05 01' for 'slags from primary and secondary production', with a red '-' button to its right. The 'Keywords' section shows 'Automatic keywords based on EWC codes:' with buttons for 'Furnace', 'Slags', 'Zinc', 'slag', and 'blast'. Below this is a 'User specific keywords:' field with a 'Keywords' input box. At the bottom is a 'Description:' field.

Resource Details

HAVE

Resource name:

zinc

EWC Codes:

Add known code: 1 1 1 +

Current List:

EWC Code	Description
10 05 01	slags from primary and secondary production

Keywords:

Automatic keywords based on EWC codes:

Furnace Slags Zinc slag blast


User specific keywords:

Keywords

Description:

- Resource reuse management platform
- Based on 10 years' experience and data from 30,000 companies
- Used in 22 countries, 6 continents
- Hosting data from 30,000 companies
- Horizon 2020 next generation development of SYNERGie® 2.0
- EWC, BREF, SIC, UN CPC

- H2020 SPIRE-6: Energy and resource management systems for improved efficiency in the process industries

				
International Synergies Ltd.	University of Twente	University of Leeds	Zurich University of Applied Sciences	Instituto de Tecnología Cerámica
				
Universitat Politècnica de Catalunya	Dechema E.V.	Chemie-Cluster Bayern	Keros Ceramica, S.A.	Kerafrit, S.A.
				
Iberica de Suspensiones, S.A. (Sogefi Group)	Grupo Guzman	Eskisehir Chamber of Industry	INNOVACIO I RECERCA INDUSTRIAL I SOSTENIBLE SL	

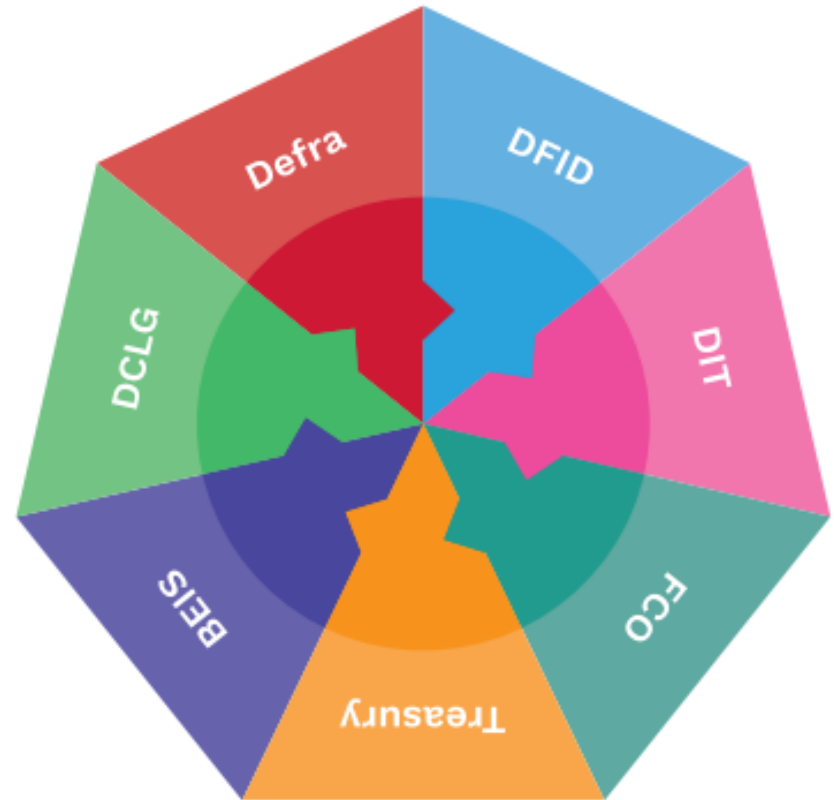
National Industrial Strategy

Industrial Symbiosis

contribution:

International Synergies
industrial ecology solutions

- Enhance competitiveness
- Secure future resources
- Deliver on environment
- Systems approach
- Circular economy in action
- Untapped potential
- Measurable outcomes
- Coordinating function
- Not just industry
- Demand pull on innovation
- Create and safeguard jobs





Department for
Business, Energy
& Industrial Strategy

Industrial Symbiosis contributes to policy goals

- Industrial strategy post BREXIT
- Green Growth
- Competitiveness
- Demand-pull innovation
- Jobs
- Entrepreneurship
- Carbon budget
- National materials database for resource security
- Energy efficiency

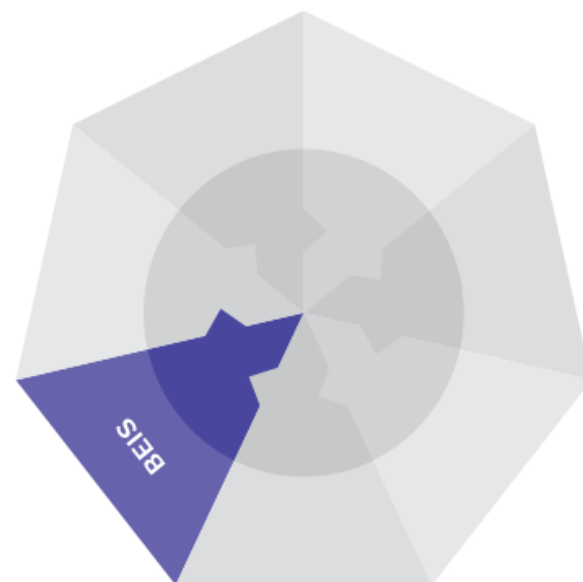
OECD *"Industrial Symbiosis is systemic innovation vital for future green growth"*

Edie.net *"NISP best low carbon project"*

BEIS *"Whole economy approach to tackling climate change"*

NISP *"20% of synergies involve new R&D"*

International Synergies study on behalf of Innovate UK identified through industrial symbiosis "over 17 million tonnes of alternative raw materials generated each year that is available for reuse by the construction industry"



Delivering the Strategy

A UK centre of excellence for Industrial Symbiosis

To achieve the vision of a national strategy the establishment of a UK centre of excellence would provide a mechanism to pull the multiple policy threads together in a whole systems approach and act as a focal point for government and industry alike.

Objectives

- Increase competitiveness of UK industry
- Informing policy
- Aligning research agendas with industry needs
- Promoting industrial symbiosis worldwide to combat Global Climate Change
- Increase exports of cleantech/greentech
- Identify inward investment opportunities
- Increase productivity through innovation



In Summary

National Industrial Symbiosis Strategy - UK taking the lead

Investment in a national strategy can be justified on so many individual levels (jobs, climate change mitigation, innovation, waste, resource security etc.) but taken together the case is compelling. The primary motivation behind a strategy is to improve UK competitiveness. In addition, a strategy would be a concrete follow up action from the UK in response to the G7 Alliance on Resource Efficiency from 2015 and demonstrate world leadership in this vitally important area for green growth.

Rationale for a strategy

- Opportunity cost
- Timing right (Brexit)
- Global uptake
- Cross-departmental synergies
- Measurable
- Value for money
- Strategic policy alignment across departments
- Building on existing structures and investments
- New markets, jobs, innovation, partnerships



Evidence Base

There is a substantial independent body of evidence that supports industrial symbiosis as a tool to deliver not only on UK competitiveness but also on global agendas including green growth, eco-innovation, climate change mitigation and sustainable development goals (particularly 8, 9, 11, 12, 13 and 17). The list below contains just some of the sources of evidence that are available.

UK Evidence

- CBI
- EEF
- Manchester Economics
- University College London
- University of Birmingham
- Institute for Manufacturing
- Cambridge
- Invest Northern Ireland
- Defra
- Walport Report 2016
- Birmingham City Council
- National Audit Office
- Highways England
- MIROG

International Evidence

- Circular Economy package
- Roadmap to a Resource Efficient Europe
- WWF
- COWI report for DG ENV
- OECD
- UNEP, UNIDO, UNDP
- G7 alliance on resource efficiency
- Technopolis report for DG INNO
- European Resource Efficiency Panel Recommendations
- Global Green Business Summit
- SPIRE
- Global Green Growth Forum (3GF)
- Worldwatch Institute



| Three take-aways

Facilitated industrial (urban/city) symbiosis is:

- Delivering the circular economy TODAY
- Ideally delivered locally/ regionally with national co-ordination providing added value and efficiencies
- Strategic policy tool for governments to achieve green growth
- A logical pillar of an UK Industrial Strategy

“Scaling up what works is the best strategy for green growth”

Global Green Growth Forum (3GF)

Thank you for listening

Peter Laybourn, Chief Executive

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