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## Publishable Executive Summary

Circular economy has entered the policy lexicon in recent years, complementing efforts on resource efficiency. The new EU Circular Economy package identifies industrial symbiosis as a key strategy for delivering a circular economy that is competitive and creates growth and jobs. The Council of the European Union has adopted in June 2016 the following Conclusion on the action plan for a circular economy: *“CONSIDERS the active involvement of the private sector and other stakeholders across Europe and at the global level a key element for a successful and more effective transition towards a Circular Economy; ENCOURAGES the EU and the Member States, at all levels of government, to actively engage the private sector to promote cooperation, **innovation and industrial symbiosis projects** within and across sectors and value chains; including by addressing specific challenges in the transition to the Circular Economy, through agreements between stakeholders in society and governments.”*

Circular economy encompasses many approaches to a resilient economy. This report focuses on industrial symbiosis as a strategy to deliver the circular economy:

Industrial symbiosis engages diverse organizations in a network to foster eco-innovation and long-term culture change. Creating and sharing knowledge through the network yields mutually profitable transactions for novel sourcing of required inputs, value-added destinations for non-product outputs, and improved business and technical processes.

Industrial symbiosis is a building block of the circular economy, a means to sustainable growth increasing resource efficiency and SMEs competitiveness and resiliency. By exploiting synergies that keep process by-products and waste in productive use as input to other processes among companies, industrial symbiosis reduces waste generation while delivering economic, environmental and social benefits.

Although there are few, if any, policies explicitly advocating industrial symbiosis, it is increasingly seen as a strategic policy tool for economic growth, innovation, economic and industrial development, and resource efficiency all levels — local, regional, national, and international. Global institutions are increasingly recognising its contribution to global agendas including circular economy, innovation, economic development, the environment and sustainable development goals.

Whilst there is still limited understanding of which policies at which levels are most effective in promoting industrial symbiosis, it is clear from the UK NISP experience 2005-2013 that industrial symbiosis needs **no** specific legislation to be successful. Policies shape the context within which business operates, and business responds to the context: if in that context waste is expensive (such as with a substantial landfill tax), then business seeks alternatives to landfill disposal. If that context restricts innovation through prescription (such as with the Industrial Emissions Directive) or restricts movement (Basel Convention), then businesses will respond accordingly. In particular, if the context is ambiguous (such as with the Waste Framework Directive End of Waste criteria), business as a whole may be expected to pursue conservative, risk-avoiding behaviour.

## Acronyms and abbreviations

ABPR	Animal By-Products Regulation
CBI	Confederation of British Industry
CE	Circular Economy
EC	European Commission
IPPC	Integrated Pollution Prevention and Control
NISP	National Industrial Symbiosis Programme
PRN	Packaging Recovery Notes
SDG	Sustainable Development Goals
SME	Small and Medium Enterprise
WFD	Waste Framework Directive

## Introduction

Circular economy has entered the policy lexicon in recent years, complementing efforts on resource efficiency. Various studies have assessed the policy barriers and incentives for the circular economy generally.<sup>1</sup> The new EU Circular Economy package identifies industrial symbiosis as a key strategy for delivering a circular economy that is competitive and creates growth and jobs.<sup>2</sup> Circular economy is an all-encompassing notion: “The transition to a circular economy will need to involve all stakeholder groups: government, business and finance, civil society and citizens”.<sup>3</sup> The Council of the European Union has adopted in June 2016 the following Conclusion on the action plan for a circular economy : “*CONSIDERS the active involvement of the private sector and other stakeholders across Europe and at the global level a key element for a successful and more effective transition towards a Circular Economy; ENCOURAGES the EU and the Member States, at all levels of government, to actively engage the private sector to promote cooperation, **innovation and industrial symbiosis projects** within and across sectors and value chains; including by addressing specific challenges in the transition to the Circular Economy, through agreements between stakeholders in society and governments.*”

Circular economy encompasses many approaches to a resilient economy. Industrial symbiosis is a building block of the circular economy, a means to sustainable growth increasing resource efficiency and SMEs competitiveness and resiliency.<sup>4</sup>

Industrial symbiosis engages diverse organizations in a network to foster eco-innovation and long-term culture change. Creating and sharing knowledge through the network yields mutually profitable transactions for novel sourcing of required inputs, value-added destinations for non-product outputs, and improved business and technical processes.<sup>5</sup>

This report focuses on that aspect of the circular economy in action. By exploiting synergies that keep process by-products and waste in productive use as input to other processes, industrial symbiosis reduces waste generation while delivering economic, environmental and social benefits.

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<sup>1</sup> Centre for European Policy Studies. The Circular Economy: Barriers and Opportunities for SMEs. V. Rizos, A.Behrens, T.Kafyeke, M.Hirschnitz-Garbers and A. Ioannou No. 412 / September 2015 Working document; European Parliamentary Research Service, various <https://epthinktank.eu/2016/02/18/circular-economy-the-second-round/>; European Environment Agency Report No 2/2016. Circular Economy in Europe – Developing the Knowledge Base.

<sup>2</sup> European Parliament, Briefing Document. January, 2016. Closing the Loop: New Circular Economy Package. PE 573.899; European Parliamentary Research Service, Briefing September 2016. Circular Economy Package: Four legislative proposals on waste. PE 589.797.

<sup>3</sup> European Environment Agency Report No 2/2016. Circular Economy in Europe – Developing the Knowledge Base

<sup>4</sup> Communication from the Commission to the European Parliament, The Council, The European Economic and Social Committee and the Committee of the Regions. Towards a circular economy: A zero waste programme for Europe COM(2014) 398 final/2

<sup>5</sup> Lombardi DR and PT Laybourn. 2012. Redefining Industrial Symbiosis: Crossing Academic - Practitioner Boundaries. Journal of Industrial Ecology 16(1): 28-37.

## Industrial symbiosis: the circular economy in action

Over the last decade and more, industrial symbiosis has been taken up on every continent, successfully crossing cultures and economies. An industrial symbiosis approach has been implemented around the world to deliver benefits that cross the 3 pillars of sustainability and support the delivery of the circular economy in action<sup>6</sup>:

**Improved productivity and competitiveness:** The inefficient use of materials, energy and water, and generation of waste represent costs to business affecting productivity and competitiveness. Finding productive use for what was waste creates opportunities to add value to previously underused and discarded resources. Productivity and competitiveness are enhanced by reducing the cost of both inputs and disposal.

**Increased revenues and profit:** Industrial symbiosis enables business generating waste to save on the treatment and disposal costs by transferring the waste (or by-product) to another industry for reuse and potential new sources of revenue. Often waste requires mechanical or chemical reprocessing to fit the market requirements for reuse, which stimulates innovation and supports green jobs. Industrial symbiosis increases profit and resilience by finding new sources of materials at lower costs.

**Reduced industrial pollution:** Re-using waste products and by-products reduces industrial pollution and improves the environment for local communities.

**Reduced risk through diversification:** By sourcing inputs from non-traditional sources, businesses build alternative supply chains that, through diversification, make the businesses more resilient.

**Improved material security:** Especially in supply-constrained conditions, industrial symbiosis ensures that access to vital inputs such as water, energy and raw materials are secured through novel sourcing.

**Access to innovation:** the cross-sector engagement inherent in industrial symbiosis has the further benefit of stimulating cross-sector innovation through exposure to different techniques and processes.

Although there are few, if any, policies explicitly advocating industrial symbiosis, it is increasingly seen as a strategic policy tool for economic growth, innovation, economic and industrial development, and resource efficiency all levels — local, regional, national, and international. Global institutions are increasingly recognising its contribution to global agendas including circular economy, innovation, economic development, the environment and sustainable development goals (SDGs).

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<sup>6</sup> Lombardi DR and PT Laybourn, 2016, Industrial Symbiosis: Connecting Industry, Creating Opportunity. Guide for Data Collection. Workbook developed for Switch Africa Green Grant MC/UNEP/00091206/032-02.

## Policies supporting circular economy through industrial symbiosis

Recent European policy documents have supported industrial symbiosis as an integral part of economic and environmental policy. A significant advance has been via the Resource Efficiency Flagship Initiative<sup>7</sup>, part of the Europe 2020 Strategy, the growth strategy for Europe whose vision is a “smart, sustainable and inclusive Europe”. The Europe 2020 strategy provides a general policy framework and various headline targets to guide policy action up to 2020.

The EU Flagship Initiative “Resource Efficient Europe” was launched to tackle resource efficient production, including finding ‘new ways to reduce inputs, minimise waste’, and using industrial symbiosis to boost efficient production. The Commission communication states: ‘increasing recycling rates will reduce the pressure on demand for primary raw materials, help to reuse valuable materials which would otherwise be wasted, and reduce energy consumption and greenhouse gas emissions from extraction and processing’.<sup>8</sup>

The Resource Efficient Europe Flagship Initiative led to the publication of the Roadmap for a Resource Efficient Europe<sup>9</sup>, recognising the potential role of industrial symbiosis in boosting efficient production by improving the reuse of raw materials and process residuals through the collaboration between companies. It is further recommended that exploiting resource efficiency gains through industrial symbiosis should be replicated across the 27 member states of the European Union (EU). The roadmap also sets the milestone of managing waste as a resource by 2020. The UK’s National Industrial Symbiosis Programme (NISP®) is cited as a best practice exemplar of concrete action already being taken by member states<sup>10</sup>. The EC report estimates that improving the reuse of raw materials through pan-European industrial symbiosis along the lines of NISP® could save €1.4 billion a year and generate €1.6 billion a year in sales.

The European Commission’s DG GROWTH, Directorate General for Internal Market, Industry, Entrepreneurship and SMEs, has advocated industrial symbiosis as a policy instrument for growth in its strategy document ‘Sustainable Industry: Going for Growth and Resource Efficiency’<sup>11</sup> which cites Kalundborg as a practical example of industrial symbiosis underpinning local and regional growth. This document is important for its connection to the growth agenda.

The European Resource Efficiency Platform (EREP) was established in 2012 with the objective of providing high-level guidance to the European Commission, Member States and private actors on the transition to a more resource-efficient and resilient economy. In its 2012 manifesto<sup>12</sup> EREP extended resources to include soil and ecosystem services. EREP has linked resource efficiency to a regenerative circular economy:

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<sup>7</sup> See [http://ec.europa.eu/europe2020/index\\_en.htm](http://ec.europa.eu/europe2020/index_en.htm) accessed 28Nov2011

<sup>8</sup> Communication From The Commission To The European Parliament, The Council, The European Economic And Social Committee And The Committee Of The Regions. A Resource-Efficient Europe – Flagship Initiative Under The Europe 2020 Strategy Brussels, 26.1.2011. Com(2011) 21 Final

<sup>9</sup> See [http://ec.europa.eu/environment/resource\\_efficiency/](http://ec.europa.eu/environment/resource_efficiency/)

<sup>10</sup> COWI 2011. *Economic Analysis of Resource Efficiency Policies*. Report for DG Environment. COWI: Kongens Lyngby, Denmark.

<sup>11</sup> See [http://ec.europa.eu/enterprise/index\\_en.htm](http://ec.europa.eu/enterprise/index_en.htm).

<sup>12</sup> [http://ec.europa.eu/environment/resource\\_efficiency/documents/erep\\_manifesto\\_and\\_policy\\_recommendations\\_31-03-2014.pdf](http://ec.europa.eu/environment/resource_efficiency/documents/erep_manifesto_and_policy_recommendations_31-03-2014.pdf) accessed Nov 2016



*“In a world with growing pressures on natural resources, the EU will need a systemic change in the use and recovery of resources in order to improve the resilience of our environment, societies and economies, within the boundaries of the planet. This should boost competitiveness and contribute to a sustainable, reindustrialised European economy. According to a recent estimate, the EU could realistically reduce the total material requirements of its economy by 17% to 24%, boosting GDP and creating between 1.4 and 2.8 million jobs”.<sup>13</sup>*

In 2014, the high-level European Resource Efficiency Platform called for industrial symbiosis to be encouraged in all EU member states. In its final recommendations (2014), the link was further made to economic stability:

*“We, the European Resource Efficiency platform, see resource efficiency as an economic strategy to help us deal with increasing pressure on natural resources and leave the crisis stronger and more resilient than before. We believe that resource efficiency will boost our economy, keep us within planetary boundaries, decouple economic growth from the use of natural resources and improve our quality of life. This is why we called in our Manifesto of December 2012 for Europe to promote resource efficiency and move to a circular economy.”*

The following policies and frameworks have proven to promote industrial symbiosis implementation in practice:

- **Waste Framework Directive: Landfill taxes.**

The EU Waste Framework Directive (WFD)<sup>14</sup> is responsible for setting the overarching legislative framework including the waste hierarchy, polluter pays and end of waste status. The WFD sets binding targets for recycling, and requires member states to draw up waste management plans and waste prevention programmes.

Landfill tax has been applied in some countries to discourage landfill as a disposal option. Charging rates depend on the characteristics of the waste; inert or inactive waste generally incurs a lower charge. The aim of the landfill tax is to encourage waste minimization and to promote more environmentally friendly reuse and recycling. In line with the waste hierarchy. Increasing the relative costs of landfilling creates drivers for industrial symbiosis.

Landfill tax in the UK and Denmark has been very effective in incentivizing industrial symbiosis amongst companies. In the UK from 2005 to 2008, the landfill tax was hypothecated to support NISP, which in turn supported the companies to reduce waste and improve efficiency through industrial symbiosis. The landfill tax escalator was introduced in 2010, providing businesses with certainty in planning and an increasingly powerful incentive to divert waste from landfill. The landfill escalator, in particular, created economic opportunities to develop plastic waste

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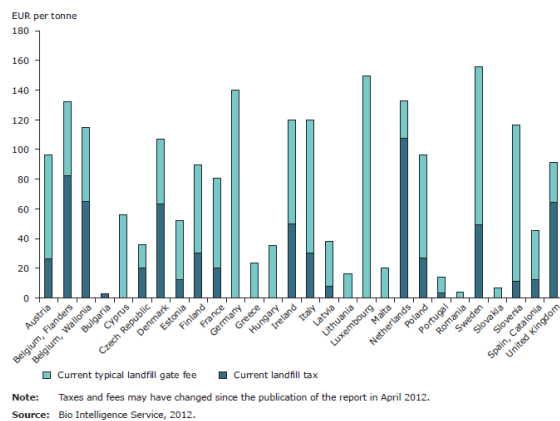
<sup>13</sup> “Macroeconomic modelling of sustainable development and the links between the economy and the environment (2011), GWS for the Commission. See also “The opportunities to business of improving resource efficiency” (2013) AMEC for the Commission, and “Resource Revolution: Meeting the world’s energy, materials, food and water needs (2011) McKinsey Global Institute.

<sup>14</sup> See <http://ec.europa.eu/environment/waste/framework/index.htm>

management system so that polymer material can be returned to the supply chain as raw materials. In Denmark, the high landfill tax is part of the flexible waste management policy, combining environmental requirements with high landfill and incineration taxes, and attributed with fostering industrial symbiosis.<sup>15</sup>

Landfill tax across the EU varies dramatically, as evidenced in the recent European Environment Agency report<sup>16</sup>, Figure 2.16 reproduced here.

Figure 2.16 Typical charge (gate fee and landfill tax) for legal landfilling of non-hazardous municipal waste in EU Member States and regions



- **Waste Framework Directive: Landfill bans.**

Landfill bans are introduced to incentivize innovation, identify new uses or processes for existing waste streams, so that the waste streams are no longer generated. Landfill bans also create incentives for material substitution and industrial symbiosis. Amendments proposed in 2016 would introduce a landfill ban for separately collected waste, which could further improve the market context for recovery operations, as more companies will have to find alternatives to landfill disposal for recyclates including plastics, paper/card, metal and glass. In June 2009, the UK Environment Secretary announced a wide-ranging review of the use of packaging materials and indicated that a ban on sending aluminium cans to landfill was being considered; this incentivized entrepreneurs to install additional recovery capacity in the UK.

The EU Animal By-Products Regulation (ABPR) 1774/2002 divides animal-derived waste products into three categories depending upon their perceived risk to health and the environment, and prescribes suitable disposal routes for each of them. It effectively bans the landfilling of all animal by-products unless they have undergone some form of prior treatment, while specifically excluding some materials completely. The ABPR came into force on 1st May 2003, at which point it became illegal to send the following to landfill: raw meat and fish; any product containing raw meat and fish; meat and fish processing wastes (such as blood, hides, feathers, bones); and raw eggs. The threat of animal by-product landfill ban incentivized companies to explore alternative routes of disposal for these waste flows; some are now being processed into new products (including blood and bone meal, biodiesel) creating value and keeping valuable nutrients in productive use.

<sup>15</sup> idea consultants for DG Enterprise & Industry. 2013. Exchange of good policy practise promoting Innovative/ Green Business Models.

<sup>16</sup> European Environment Agency. 2013. Managing Municipal Solid Waste — a review of achievements in 32 European countries. Report No. 2/2013. ISSN 1725-9177

- Packaging Directive: Packaging Recovery Notes.

The EU Directive on Packaging and Packaging Waste requires Member States to prevent packaging waste and develop packaging reuse systems, focusing on paper and cardboard, glass, plastic, wood and metal. The producer responsibility obligations require companies to recover and recycle packaging. In Great Britain, the introduction of the Producer Responsibility Obligations (Packaging Waste Regulations 2007) system of Packaging Recovery Notes (PRNs) provide the evidence of recycling or recovery; PRNs are purchased on behalf of packaging producers to fund the recycling of their products at end of life. Accredited reprocessors have developed business models based on the market value of PRN (ranging from £10-£65/tonne for aluminium in the last year).

- Waste exemptions (Industrial Emissions Directive)

The EU Industrial Emissions Directive, transposed into UK law through the Environmental Permitting Regulations, includes an exemption framework to facilitate businesses processing small volumes of low-risk waste. This removes a significant cost and resource barrier for industry: the requirement of applying for a permit and the associated annual fees. The exemptions are quickly applied for online and aids the reuse, recycling and storage of wastes on site. The exemption framework covers construction waste, materials being converted to biofuels, and land spreading pig and poultry ash.

- Research and Innovation Strategy for Smart Specialisation (RIS3)

Resource Efficiency and SME competitiveness are fundamental to the Europe 2020 strategy for smart, sustainable and inclusive growth. They enable the development of strong and resilient regional economies, which help to increase employment and reduce poverty. Inefficient resource use by Europe's SMEs has been identified by the European Commission as a clear market failure creating additional and unnecessary costs that constrain growth, contribute to greenhouse gas emissions, and further exploit scarce natural resources<sup>17</sup>.

Industrial symbiosis connects traditionally separate industries through facilitation, thus enabling them to divert wasted by-products and resources into productive and value-added uses elsewhere in the economy. Waste management and industrial symbiosis are both strongly linked to the Research and Innovation Strategies for Smart Specialisation (RIS3)<sup>18</sup>: the strategic priority promotes green and blue economy, innovation on waste management and rational use of resources. The issue is also mentioned in the driver '2<sup>nd</sup> and 3<sup>rd</sup> life of materials and products with a focus on industrial symbiosis. RIS3 expect also innovative normative actions in the field of waste management.

NISP® is a world leading exemplar project cited in RIS3. RIS3 states that the use of industrial symbiosis will "Encourage the citizens to adopt sustainable lifestyles and consumption patterns by integrating intelligent city planning using industrial symbiosis programmes", and enhances the "SME competitiveness for synergies between the production processes of companies and

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<sup>17</sup> European Resource Efficiency Platform, 2014, Manifesto and Policy Recommendations. 31 March

<sup>18</sup> European Parliamentary Research Service. Briefing January 2016. Smart Specialisation: The concept and its application to EU cohesion policy. PE 573.912

the needs of other companies that can recover, reprocess, and reuse wasted resources from the original production processes.”

In 2012, the European Commission’s Directorate General for Regions included industrial symbiosis as an exemplar in its policy Connecting Smart and Sustainable Growth through Smart Specialisation. Regional industrial development is the key driver for incorporation in regional plans in Turkey. Industrial development is the focus of South Korea’s national investment in industrial symbiosis.

An increasing number of global, international and national institutions and representative groups are championing further development and support of industrial symbiosis. The Organisation for Economic Cooperative Development cited industrial symbiosis as a form of systemic eco-innovation “vital for future green growth”<sup>19</sup>. In June 2015, the G7 Leaders, under the German presidency, made a commitment to establish a G7 Alliance on Resource Efficiency to act as a platform for sharing knowledge and network. The UK and Germany jointly hosted the first event under the G7 banner in Birmingham on 29-30 October 2015 focusing on advancing industrial symbiosis within the context of Resource Efficiency. The workshop was attended by over 100 policy makers, industry representatives and academic pioneers from countries within the G7, G20 and emerging economies.

The WorldWide Fund for Nature (WWF) commissioned a report examining the private-sector innovation contributing to green growth which highlighted International Synergies’ (the company that devised and manages NISP) approach to industrial symbiosis as one of the “World’s Top 20 Green Game-Changing Innovations”<sup>20</sup>. The Nordic Council of Ministers commissioned desk research and interviews to identify existing local, regional, national and international policies within this area that have successfully supported industrial symbiosis, and barriers to its dissemination. In Portugal, the National Waste Management Plan, 2011-2020, explicitly identifies industrial symbiosis as a key strategy to be pursued<sup>21</sup>.

At a more local/regional scale companies and municipalities alike are increasingly thinking of industrial symbiosis as a strategic tool. Birmingham City Council (the largest single municipality in Europe) published its Big City Plan in 2011 for the development of the Tyseley Environmental Enterprise District, a significant industrial area of Birmingham that had lost many of its traditional employers. Birmingham’s vision is for Tyseley to become the “principal location in Birmingham for CO<sub>2</sub> reduction as part of a low carbon, low waste economy” by “exploiting opportunities around industrial symbiosis, utilising existing business waste streams and power generation.” The Plan details Birmingham City Council’s commitment to work with local businesses to develop a cluster of enterprise activity focused upon encouraging an industrial symbiosis approach to growth and innovation.<sup>22</sup>

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<sup>19</sup> OECD (Organisation for Economic Cooperation and Development). 2010. Project on Green Growth and Eco-Innovation. Paris: OECD. [www.oecd.org/dataoecd/43/48/45169190.pdf](http://www.oecd.org/dataoecd/43/48/45169190.pdf) accessed 17Nov2010

<sup>20</sup> WWF (World Wildlife Fund). 2010. Green Game Changing Report. Available at [www.international-synergies.com/Downloads/WWF\\_Green\\_Game\\_Changing\\_Report\\_2011.pdf](http://www.international-synergies.com/Downloads/WWF_Green_Game_Changing_Report_2011.pdf). Worldwide Fund for Nature: London.

<sup>21</sup> See [http://www.apambiente.pt/concursos/TGR/Documents/PNGR\\_2011-2020.pdf](http://www.apambiente.pt/concursos/TGR/Documents/PNGR_2011-2020.pdf).

<sup>22</sup> See [www.birmingham.gov.uk](http://www.birmingham.gov.uk)

Building on this experience, the city of Birmingham is leading the INTERREG project TRIS – Transitioning Regions to Industrial Symbiosis – to address the challenge of enabling a systemic uptake of industrial symbiosis in 5 European regions, supporting policy makers to increase the competitiveness of their SMEs by introducing industrial symbiosis practices. The TRIS consortium will identify facilitating elements and obstacles and embed them in (or remove them from) the appropriate policy instruments; and reach out and engage with the actors that can drive and/or be impacted by the change and involve them in structured local networks.

In addition to the above the Appendix to this report details further examples of policies and recommendation that could be classified as ‘weak’ enablers i.e. supportive policy but without any mandatory requirement for action.

### Policies creating barriers to the circular economy through industrial symbiosis

Policies creating barriers to industrial symbiosis are those that: obfuscate or complicate definitions leading to lack of clarity for business and risk-avoiding behaviour; limit flexibility of industry to respond to changing context; and introduce additional burdens on shipments of waste and secondary raw materials for productive use.

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (adopted in 1989) is legislation that aims to protect human health and the environment against the adverse effects of hazardous wastes. The legislation lays down a legal framework of notice, consent and tracking for managing waste transfers across international borders, transposed into Trans-frontier Shipping Regulations. The broad definition of industrial waste as hazardous in Annex I and III means that a wide variety of resource flows suitable for recovery and reuse falls under the Convention. The process of 30-day prenotification and application for prior consent is viewed by the industry as a bureaucratic barrier that may constrain otherwise viable industrial symbiosis opportunities.

The Waste Framework Directive covers the ‘End of Waste Criteria’. The aim is to encourage recycling by increasing legal certainty and removing the administrative burden of applying for waste exemptions. Although the legislation is well intended and provides a route by which industry can have its waste reclassified as product, the reality is that the paperwork, required evidence trail and the time taken to make submissions to regulatory technical panels for approval are still viewed as burdensome, expensive and bureaucratic for participating industry; that is, the process itself often creates a barrier to industrial symbiosis.

The Industrial Emissions Directive (201/75/EC) superseded the Integrated Pollution Prevention and Control (96/61/EC) Directive.<sup>23</sup> The scope of activities covered by the Industrial Emissions Directive (IED) and IPPC include: energy industries; production and processing of metals; mineral industries; chemical industries; waste management; intensive livestock-farming; large-combustion plants; waste incineration; solvent emissions; and the production of titanium dioxide. It is based on the premise of avoiding or minimising environmental impacts of an industrial activity as far as practical, using resource efficiency, waste minimisation and the principal of Best Available Techniques (BAT). Permitting establishes the activities to be

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<sup>23</sup> <http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=URISERV:l28045&from=EN>

undertaken by a company; and does not easily allow for changes to that permitted process. For example, if a company permit specifies that it will burn all methanol waste, then it cannot then decide to reuse that methanol (an action higher up the waste hierarchy), it must burn it until such time as its permits are revised.

REACH (EC 1907/2006)<sup>24</sup> is the European Union regulation on Registration, Evaluation, Authorisation and restriction of Chemicals.<sup>25</sup> It came into force on 1st June 2007 and replaced a number of European Directives and Regulations for chemicals in the EU with a single system. REACH shifts the responsibility from public authorities to industry with regards to assessing and managing the risks posed by chemicals and providing appropriate safety information for their users. REACH applies to substances manufactured or imported into the EU in quantities of 1 tonne or more per year. REACH aims to improve the protection of human health and the environment through the better and earlier identification of the intrinsic properties of chemical substances, through the registration, evaluation, authorisation and restriction of chemicals. REACH also aims to enhance innovation and competitiveness of the EU chemicals industry. Anything classified as 'waste' is exempt from the REACH legislation – REACH comes into effect if recycled materials are to be reclassified as no longer waste (= "end of waste") where it may create a barrier to putting secondary raw materials on the market.

## Conclusion

Industrial symbiosis is a building block of the circular economy, a means to sustainable growth increasing resource efficiency and SMEs competitiveness and resiliency. By exploiting synergies that keep process by-products and waste in productive use as input to other processes among companies, industrial symbiosis reduces waste generation while delivering economic, environmental and social benefits.

Although there are few, if any, policies explicitly advocating industrial symbiosis, it is increasingly seen as a strategic policy tool for economic growth, innovation, economic and industrial development, and resource efficiency at all levels – local, regional, national, and international. Whilst there is still limited understanding of which policies at which levels are most effective in promoting industrial symbiosis, it is clear from the UK NISP<sup>®</sup> experience (2005-2013) that industrial symbiosis needs **no** specific legislation to support productivity and competitiveness through resource efficiency. Policies shape the context within which business operates, and business responds to the context: if in that context waste is expensive (such as with a substantial landfill tax), then business seeks alternatives to landfill disposal. If that context restricts innovation through prescription (such as with the Industrial Emissions Directive) or restricts movement (Basel Convention), then businesses will respond accordingly. In particular, if the context is ambiguous (such as with the Waste Framework Directive End of Waste criteria), business as a whole may be expected to pursue conservative, risk-avoiding behaviour.

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<sup>24</sup> <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32006R1907>

<sup>25</sup> [http://ec.europa.eu/environment/chemicals/reach/reach\\_en.htm](http://ec.europa.eu/environment/chemicals/reach/reach_en.htm);  
<http://ec.europa.eu/growth/sectors/chemicals/reach>

## Appendix

### UK-specific policy context<sup>26</sup>

The influential British business organisation, Confederation of British Industry (CBI), published a report calling for the UK Government to review its policies concerning business waste and resource efficiency. This report singled-out NISP as an example of effective and innovative support for business.<sup>27</sup>

Although not specifically mentioning industrial symbiosis, the goals of the following recent UK Government strategy reviews outlined below are consistent with the very practical, pragmatic and proven approach of industrial symbiosis which has been pioneered by the UK.

#### **National Security Strategy and Strategic Defence and Security Review 2015**

Key elements supported by industrial symbiosis:-

- Encouraging economic innovation
- Strengthening resilience to disasters, shocks and climate change
- Support growth and sustainable economic development
- Building partnerships with small companies

#### **UK Aid: tackling global challenges in the national interest (November 2015)**

Key elements supported by industrial symbiosis:-

- Mitigate climate change
- Promote economic development and prosperity
- Strengthen UK Trade and Investment opportunities
- Prioritise disaster preparedness

#### **Site Waste Management Plans Regulations 2008**

The Site Waste Management Plans Regulations<sup>28</sup> (2008-2013) required all construction and demolition projects greater than £300k in value to identify all wastes expected to arise from a project ahead of any works taking place. Project management required an outline of quantities, segregation practices, management responsibility and storage arrangements.

Many companies maintained the discipline of producing plans on a voluntary basis after the Regulation's repeal in 2013, as the Plans have been instrumental in helping projects make efficient use of their resources, reduce waste disposal costs and meet the legal requirements of the Duty of Care. The waste management plans also provide an inventory of wastes which is key to mapping material flows and identifying potential cost savings and carbon reduction through industrial symbiosis activity.

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<sup>26</sup> <https://www.gov.uk/guidance/waste-legislation-and-regulations>

<sup>27</sup> CBI (Confederation of British Industry). 2011 *'Making ends meet'* London: Confederation of British Industry. February. [http://www.cbi.org.uk/Making\\_Ends\\_Meet](http://www.cbi.org.uk/Making_Ends_Meet)

<sup>28</sup> <http://www.legislation.gov.uk/uksi/2008/314/contents/made>



## European policy context

### European policies related to industrial symbiosis include:

- **2008 The Raw Materials Initiative [COM 2008 699 final](#)** sets out a strategy for tackling the issue of access to raw materials in the EU. This strategy has three pillars which aim to ensure:
  - [Fair and sustainable supply of raw materials from global markets](#);
  - [Sustainable supply of raw materials within the EU](#);
  - [Resource efficiency and supply of "secondary raw materials" through recycling](#).
- **2011 The Resource Efficiency Roadmap [COM \(2011\) 571 final](#)** outlines how we can transform Europe's economy into a sustainable one by 2050. It proposes ways to increase resource productivity and decouple economic growth from resource use and its environmental impact. It illustrates how policies interrelate and build on each other.
- **2012 A Stronger European Industry for Growth and Economic Recovery - Industrial Policy Communication Update [COM\(2012\) 582 final](#) Quote:** Tomorrow's factories will use highly energy- and material-efficient processes, employ renewable and recycled materials, and increasingly adopt sustainable business models such as **industrial symbiosis** to recover materials and dissipated heat and energy.
- **2013 Review of the [7<sup>th</sup> Environmental Action Programme](#).** The Action Programme will be guiding European environment policy until 2020. It identifies three key objectives:
  - to protect, conserve and enhance the Union's **natural capital**
  - to turn the Union into a **resource-efficient**, green, and competitive low-carbon **economy**
  - to **safeguard** the Union's citizens from **environment-related pressures** and risks to health and wellbeing
- **2014 Communication on Green Action Plan for SMEs [COM \(2014\) 440 final](#). Quote:** Address systemic barriers to cross-sectoral and cross-national value chain collaboration and business creation and cooperation, by facilitating the creation of service business models and the re-use of materials, products and waste: f Analysis of the systemic barriers impeding the deployment of circular business models by SMEs, the efficient use of materials from waste streams and **industrial symbiosis** processes. This is crucial for developing the best possible actions at EU level to address these shortcomings and to promote the role of SMEs in the circular economy.
- **2014 DG GROW, Green Employment Initiative: Tapping into the job creation potential of the green economy [COM\(2014\) 446 final](#)** This Communication aims at defining strategic framework conditions to allow labour market and skills policies to play an active role in supporting employment and job creation in the green economy.
- **2014 [EUROPEAN RESOURCE EFFICIENCY PLATFORM: Manifesto & Policy Recommendations](#) Quote:** "The EU and Member States should foster industrial



symbiosis by promoting a pan-European network of **industrial symbiosis** initiatives, under which facilitators could be connected to allow match-making, including across borders and beyond the EU. The potential for creating new, or scaling up existing, networks should be exploited and a platform for knowledge exchange established. This would help companies to source inputs and to get value from their residues.”

- **2015 EU action plan for the Circular economy** [COM\( 2015\) 614 final](#) Communication-recommendation on industrial symbiosis: The Commission is proposing (in the revised legislative proposals on waste) to clarify rules on by-products to facilitate **industrial symbiosis** and help create a level-playing field across the EU.

European reports and publications that refer specifically to industrial symbiosis and International Synergies Ltd NISP®:

- **2011 DG GROW, [Sustainable Industry-Going for Growth & Resource Efficiency](#)** - Under the opportunities for improvement in industry and policy there is a headline on ‘Industries can work together better through **industrial symbiosis**’
- **2011 DG Environment, [Economic Analysis of Resource Efficiency Policies](#)** - The **National Industrial Symbiosis Programme (NISP)** is one of the case studies analysed in the report.
- **2012 DG Environment, [Waste Framework Directive: NISP](#)** is one of the few European best practices shortlisted.
- **2012 DG REGIO, [Connecting Smart and Sustainable growth through Smart Specialization](#)** - **NISP** is one of the case studies presented
- **2013 DG Environment, [Eco-Innovation Observatory Annual Report](#)** Industrial symbiosis is presented as a highly transformative innovation system and NISP is mentioned as a best case study.
- **2013 DG Environment, [The opportunities to business of improving resource efficiency](#)** There is specific analysis and reference to industrial symbiosis.
- **2014 DG Research & Innovation, [A Short Guide to Assessing Environmental Impacts of Research and Innovation Policy](#)**
- **2016 European Environment Agency EEA Report No 2/2016 Circular economy in Europe**