European Academies Science Advisory Council

EASAC work on the Circular Economy – Comments on Indicators via Industry Perspective

Geraldine A. Cusack, Siemens Ltd. Ireland

SIEMENS

European Academies
easac
Science Advisory Council

The Circular Economy

SIEMENS

2015 EASAC statement on the Circular Economy

European Academies easac Science Advisory Council

Provides natural and social science perspective

Specific Points:

Linear economy is the result of **failure of current pricing systems** to fully integrate all costs (including social and environmental costs).

There is **potential for improved competitiveness** and new markets, but there are also **potential disadvantages** from an economic theory perspective where policies for a circular economy are applied only within the European Union.

New **indicators** required and special measures may be needed for particularly **critical elements** required for key economy sectors.

statement

European Academies' Science Advisory Council

For further information:
secretariat@easac.eu
www.easac.eu

European Academies easac Science Advisory Council

Circular economy: a commentary from the perspectives of the natural and social sciences

Summary

In May 2015, the European Academies' Science Advisory Council (EASAC) started a review of issues related to the 'circular economy'. The circular economy involves many aspects of science, technology and social science but this commentary is intended to contribute to the debate between stakeholders on the principles and objectives of the European Commission's policy. This has been compiled by a Working Group of scientists and economists nominated by member academies of EASAC.

This commentary provides background on natural and social science aspects relevant to policy devlopment on the circular economy; it may be used to inform debate on the principles and broad approach to the circular economy. It reviews the benefits foreseen for a circular economy and potential risks for the transition phase. In a world of increasing population and per capita consumption where existing levels of consumption of resources are already well above sustainable levels, improving the efficiency with which humanity uses resources is a priority. However, barriers that stand in the way of a transition to a circular economy are substantial and increased by some current trends in corporate and consumer behaviour. EASAC accepts the rationale for, and potential qualitative benefits of, the circular economy. However, there are uncertainties over models used in quantifying the benefits, and questions remain over transition to a circular economy. Further research options to reduce these uncertainties are identified.

Underlying the barriers to shifting from a linear to a circular economy is the failure of current pricing systems to fully integrate all costs (including social and environmental costs), which means that pricing systems are failing to transmit the necessary information to inform individual decisions. A research priority is thus to increase the pace at which these external costs can be introduced. Until this failure is remedied, rules and regulatory instruments may be unavoidable, but need to be carefully designed, taking into account fields of behavioural economics, and providing sufficient flexibility to allow companies to respond in the most efficient ways and to respond to rapid changes in technology and associated effects on product life cycles.

The potential impact of a circular economy on international competitiveness is also considered. There is potential for improved competitiveness and new markets, but there are also potential disadvantages from an economic theory perspective where policies for a circular economy are applied only within the European Union. It is thus important to ensure that these policies are also fully embraced in international trade negotiations, and the United Nations policy process involving Sustainable Development Goals.

This commentary also briefly considers other issues including evaluating scarcity, eco-design and potential indicators for a circular economy, which will be examined in later stages of this project.

Circular economy | November 2015 | 1

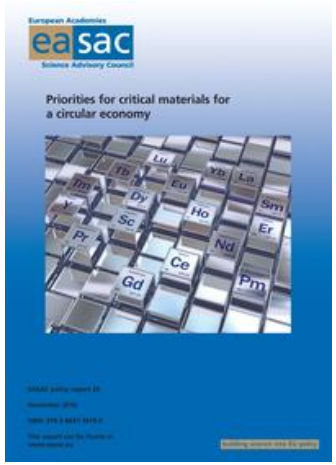
SIEMENS

CE working group members

European Academies easac Science Advisory Council

Professor Michael Norton, EASAC Environment Director

- Professor Gunter Stephan (University of Bern)
- Dr Ioannis Agapitidis, Hellenic Recycling Organisation
- Ms Geraldine A Cusack, Siemens Ireland
- Dr Anni Huhtala, VATT Institute for Economic Research (Finland)
- Professor Mark van Loosdrecht, Delft University of Technology
- Dr Ir Egbert Lox, Umicore, Belgium
- Dr Guiseppe Mininni, IRSA (Italian Water Research Institute)
- Professor Sture Öberg, University of Uppsala
- Professor Dr Ionut Purica, Romanian National Institute of Economic Research
- Professor Kristin Vala Ragnarsdottir, University of Iceland
- Professor Armin Reller, University of Augsburg
- Professor Baiba Rivza, Latvian Academy of Sciences
- Professor Filipe Santos, University of Lisbon
- Professor Roger Sheldon, Delft University of Technology
- Professor Thomas Sterner, University of Gothenburg
- Professor Richard Tol, University of Sussex

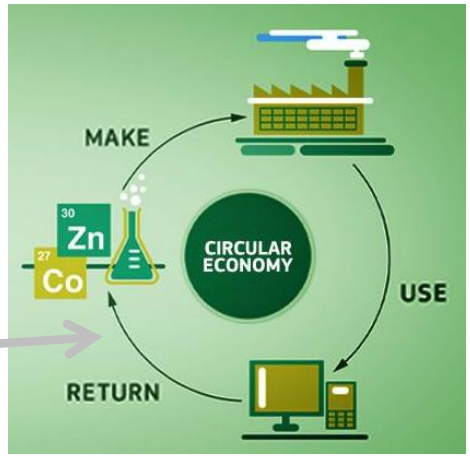


SIEMENS

Indicators

- What is the problem we are trying to solve?
- Dominance of GDP linked to linearity
- Can anything compete with GDP?
- Many attempts to find substitute indicator but no consensus yet.
- Introducing indicators for the circular economy - part of efforts to move beyond GDP and to sustainable development goals.

Circular economy indicators



SIEMENS

GDP Alternatives

Alternative Indicator	Abbreviation
Better Life Index	BLI
Ecological Footprint	EF
Environmental Pressure Index	EPI
European Environment Agency Core Set of Indicators	EEA CSI
Genuine Progress Indicator	GPI
Gross National Happiness Index	GNHI
Happy Planet Index	HPI
Human Development Index	HDI
Index of Sustainable Economic Welfare	ISEW
Sustainable Development Indicators	SDI
World Values Survey	WVS

HEADLINE INDICATORS OF THE SUSTAINABLE DEVELOPMENT INDICATOR **(SDI)** SET

SDI THEME	HEADLINE INDICATOR
Socio-economic development	Real GDP per capita
Sustainable consumption and production	Resource productivity
Social inclusion	People at risk of poverty or social exclusion
Demographic changes	Employment rate of older workers
Public health	Life expectancy and healthy life years
Climate change and energy	Greenhouse gas emissions, and primary energy consumption
Sustainable transport	Energy consumption of transport relative to GDP
Natural resources	Common bird index
Global partnership	Official development assistance
Good governance	None

SIEMENS

European Academies Science Advisory Council

Potential Indicator Sources

Indicator type	Examples	Availability of data	Relevance to the CE
Sustainable development	Social economic development, sustainable consumption and production, social inclusion, demographic changes, public health, climate change and energy, sustainable transport, natural resources, global partnership, good governance	Voluntary based reporting via EU DG Energy (focused), European Sustainable Development Network (ESDN); corporate sustainability indicators (e.g. carbon disclosure)	Natural resources, sustainable consumption and production
Environment	Agriculture, air pollution, biodiversity, climate change, energy, fisheries, land and soils, transport, waste, water	Regulatory based reporting via EEA cores indicators and country-specific statistics	Waste generated, packaging waste recycling
Material Flow	DE, DMC, DMI, PTB, NAS, DPO, TMR, TDO	Eurostat, SERI	All
Societal behaviour	Sharing, municipal waste recycle, waste generated per capita (total and segregated), environmental/resource taxation	National and voluntary organisation statistics	All
Organisational behaviour	Material flow accounting in organisations, remanufacturing, use of recycled raw materials, eco-innovation, per capita statistics (e.g. reduction in waste generation per capita)	Private sector voluntary reporting via EU Forum for Manufacturing; VDMA (German Engineering Federation); etc.	All
Economy performance	Resource productivity, recycling industry, green jobs, waste generation/GDP, 'transformation of the economy'	Eurostat EU Resource Efficiency Scoreboard	All

SIEMENS

European Academies easac Science Advisory Council

Key Message to EU Commission: No shortage so what criteria?

1. You **can't manage what you cannot measure**, nor can you review progress without monitoring it, so indicators are an essential part of policy.
2. Not just the simplest to obtain but we need **"intelligent" indicators.**
3. Should **inform and influence** stakeholders AND public, media and policymakers
4. Should aim to **show benefits of circularity** - both environmental and economic
5. Some sets **already in use** in other countries.
6. Look for **mutual reinforcement** with other trends (e.g. sustainable reporting)
7. U**se for monitoring the performance of markets** in the recycling business and address regulatory barriers, such as those related to transforming waste into secondary raw materials.

SIEMENS

European Academies Science Advisory Council

An Industry Perspective

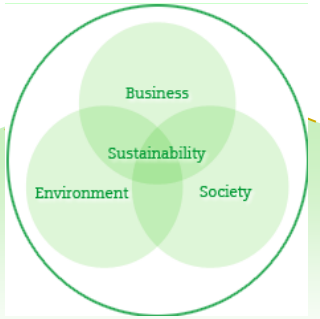
SIEMENS

European Academies Science Advisory Council

What we believe: Goal of our sustainability framework is to balance people, the environment and profit

Sustainability: Global Framework

MEMBER OF Dow Jones Sustainability Indices In Collaboration with RobecoSAM



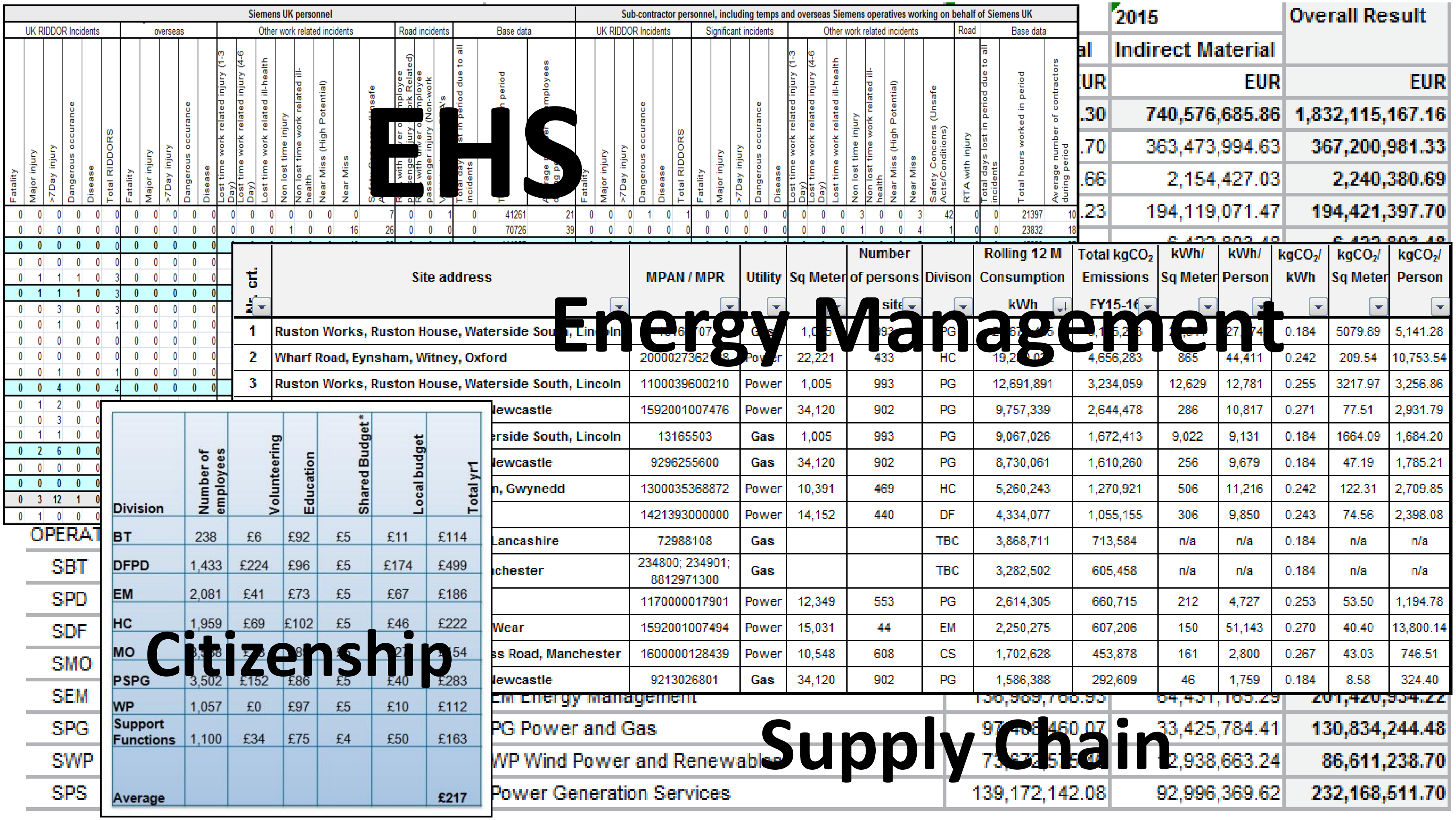
CDP DRIVING SUSTAINABLE ECONOMIES

Initiatives	Walk the talk	Alliances
We turn our approach to sustainability into concrete business opportunities	We are committed to embedding sustain-ability throughout our organization and operations	To achieve our sustainability targets, we work with all relevant interest groups

Sustainability – our guiding principle

Siemens values: excellent – innovative - responsible

How we work: Data, Data, Data...



EHS

Siemens UK personnel | Sub-contractor personnel, including temps and overseas Siemens operatives working on behalf of Siemens UK

UK RIDDOR Incidents | overseas | Other work related incidents | Road incidents | Base data | UK RIDDOR Incidents | Significant incidents | Other work related incidents | Road | Base data

Near Miss	Safety Concerns (Unsafe Acts/Conditions)	RTA with injury	Total days lost in period due to all incidents	Total hours worked in period	Average number of contractors during period
3	42	0	0	21397	10
4	1	0	0	23832	18

Energy Management

Nr. crt.	Site address	MPAN / MPR	Utility	Sq Meter	Number of persons site	Divison	Rolling 12 M Consumption kWh	Total $kgCO_2$ Emissions FY15-16	kWh/ Sq Meter	kWh/ Person	$kgCO_2$/ kWh	$kgCO_2$/ Sq Meter	$kgCO_2$/ Person
1	Ruston Works, Ruston House, Waterside Sou[illegible], Lin[illegible]	[illegible]	[illegible]	1,0[illegible]5	[illegible]93	PG	[illegible]	[illegible]	[illegible]	[illegible]	0.184	5079.89	5,141.28
2	Wharf Road, Eynsham, Witney, Oxford	2000027362[illegible]8	Po[illegible]er	22,221	433	HC	19,2[illegible]	4,656,283	865	44,411	0.242	209.54	10,753.54
3	Ruston Works, Ruston House, Waterside South, Lincoln	1100039600210	Power	1,005	993	PG	12,691,891	3,234,059	12,629	12,781	0.255	3217.97	3,256.86
	[illegible]ewcastle	1592001007476	Power	34,120	902	PG	9,757,339	2,644,478	286	10,817	0.271	77.51	2,931.79
	[illegible]rside South, Lincoln	13165503	Gas	1,005	993	PG	9,067,026	1,672,413	9,022	9,131	0.184	1664.09	1,684.20
	[illegible]ewcastle	9296255600	Gas	34,120	902	PG	8,730,061	1,610,260	256	9,679	0.184	47.19	1,785.21
	[illegible]n, Gwynedd	1300035368872	Power	10,391	469	HC	5,260,243	1,270,921	506	11,216	0.242	122.31	2,709.85
	[illegible]	1421393000000	Power	14,152	440	DF	4,334,077	1,055,155	306	9,850	0.243	74.56	2,398.08
	[illegible]Lancashire	72988108	Gas			TBC	3,868,711	713,584	n/a	n/a	0.184	n/a	n/a
	[illegible]chester	234800; 234901; 8812971300	Gas			TBC	3,282,502	605,458	n/a	n/a	0.184	n/a	n/a
	[illegible]	1170000017901	Power	12,349	553	PG	2,614,305	660,715	212	4,727	0.253	53.50	1,194.78
	[illegible]Wear	1592001007494	Power	15,031	44	EM	2,250,275	607,206	150	51,143	0.270	40.40	13,800.14
	[illegible]ss Road, Manchester	1600000128439	Power	10,548	608	CS	1,702,628	453,878	161	2,800	0.267	43.03	746.51
	[illegible]ewcastle	9213026801	Gas	34,120	902	PG	1,586,388	292,609	46	1,759	0.184	8.58	324.40

Citizenship

Division	Number of employees	Volunteering	Education	Shared Budget*	Local budget	Total yr1
BT	238	£6	£92	£5	£11	£114
DFPD	1,433	£224	£96	£5	£174	£499
EM	2,081	£41	£73	£5	£67	£186
HC	1,959	£69	£102	£5	£46	£222
MO	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]54
PSPG	3,502	£152	£86	£5	£40	£283
WP	1,057	£0	£97	£5	£10	£112
Support Functions	1,100	£34	£75	£4	£50	£163
Average						£217

Supply Chain

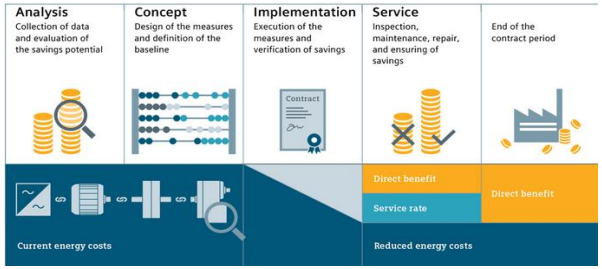
		[illegible]al [illegible]UR	2015 Indirect Material EUR	Overall Result EUR
		[illegible].30	740,576,685.86	1,832,115,167.16
		[illegible].70	363,473,994.63	367,200,981.33
		[illegible].66	2,154,427.03	2,240,380.69
		[illegible].23	194,119,071.47	194,421,397.70
OPERAT[illegible]				
SBT				
SPD				
SDF				
SMO				
SEM	[illegible] Energy Management	[illegible]	[illegible]	[illegible]
SPG	[illegible]PG Power and Gas	[illegible]	33,425,784.41	130,834,244.48
SWP	[illegible]WP Wind Power and Renewabl[illegible]	[illegible]	[illegible]2,938,663.24	86,611,238.70
SPS	Power Generation Services	139,172,142.08	92,996,369.62	232,168,511.70

SIEMENS

European Academies Science Advisory Council

Siemens is already incorporating CE principles in business models

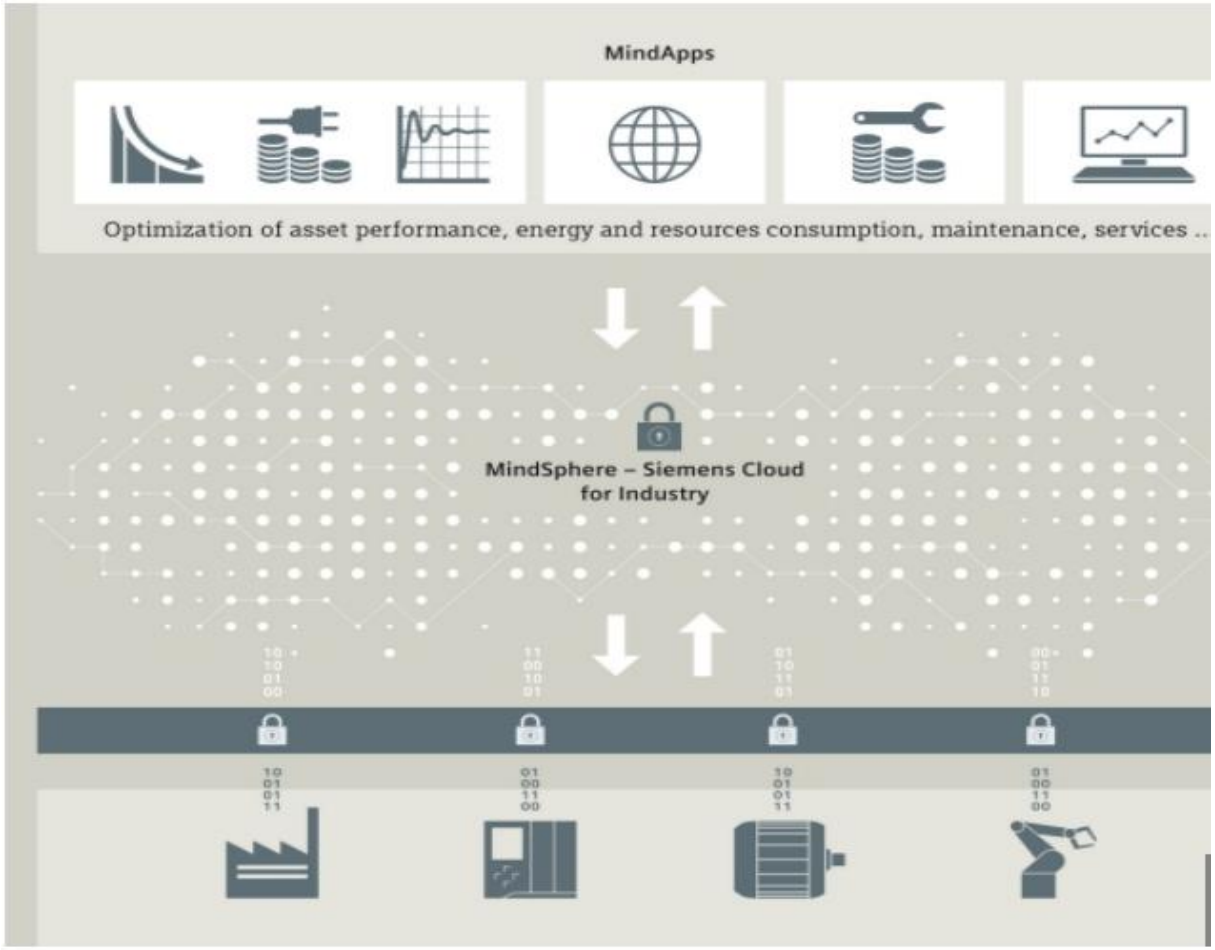
1. **Energy Performance Contracts (EPCs)** ***in Industry division*** – energy management solutions (predominantly in the Energy sector) –The clients don't own the hardware – they just pay for the service, and we the service provider ensures reliability of operations.



2. **Refurbishments** ***in the Healthcare divi*****sion**– product upgrade solutions in medical / hospital units e.g. x-ray machines, CATscans, (product lifecycle care and performance criteria in Healthcare division).

3. **Repairs** ***in the Energy Supply division*** – machine component repair and remanufacturing services (upgrading technology in the components for purposes other than originally manufactured) for Gas turbines division.

MindSphere – Siemens Cloud for Industry



Securely collect, save, and analyze large data volumes in MindSphere – Siemens Cloud for Industry

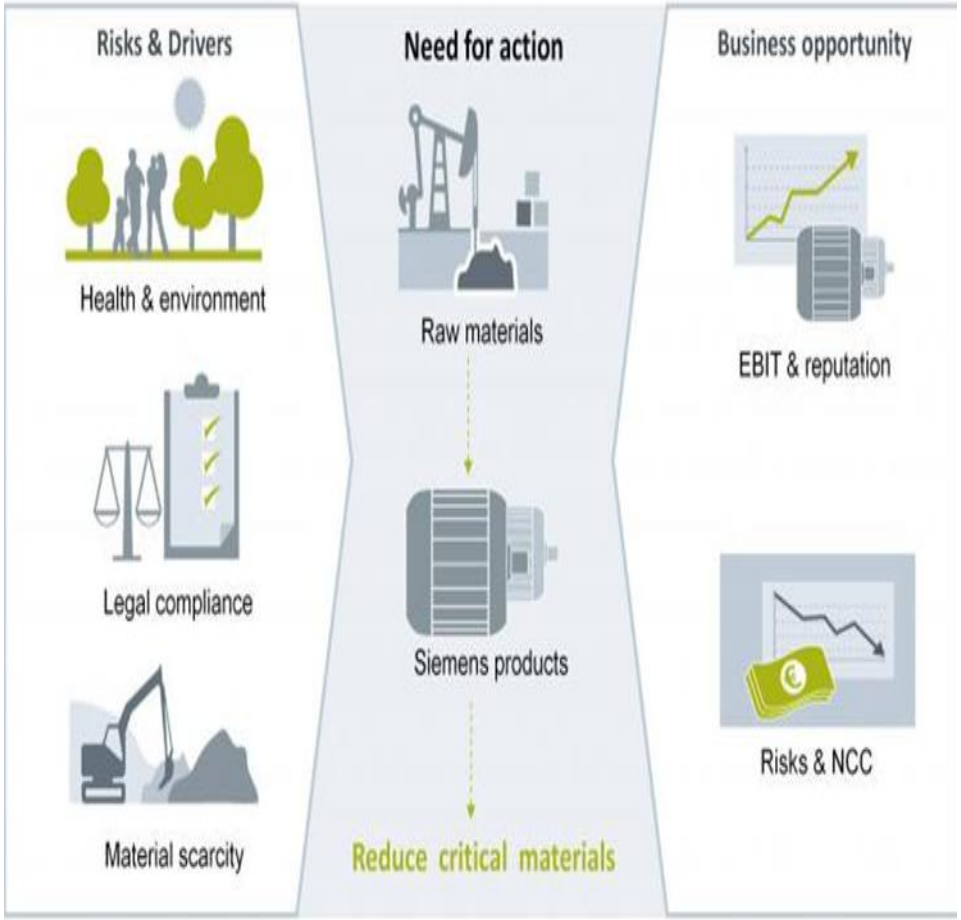
Indicators measuring the performance of a Circular Economy need to take account of various activities

Composite Indicators could therefore help to illuminate:

1. Decoupling resource use and environmental impact from varied economic activities,
2. Measuring resource efficiency and consequent waste reduction trends,
3. Tracking material flows,
4. Tracking environmental externalities,
5. Prioritizing efficient use of goods through repair and reuse schemes.

European Academies
easac
Science Advisory Council

Performance of a Circular Economy depends on:



1. Communicate & promote the needs of a Circular Economy to be accepted internationally.

2. Speak with companies on the whole issue of eco-design and design for recovery and recyclability.

3. EU does not function in a bubble - need for integrating CE principles all along the complete supply chain.

4. Fundamental systemic costing issues of business endeavours throughout the supply chain.

Key aspects for consideration

1. **Resource Productivity** measurements could be aligned with environmental pressure measurements.

2. **Material Flows** need to take account of the complexities of recycling (mixed waste streams and the value of different materials), and the value of economic output from the recycling processes.

3. **Energy and Materials indicators** should have equal importance.

4. **Indicators for water** are challenging and complex and requires proper water accounting to maximize the potential for reuse.

5. **Developing Composite Indicators** that aligned Recycling and Reuse targets via the EU Directives with measurements of the degree to which EU Member States reach the targets.

Key aspects for consideration

6. **Consultation with Industry Sectors** to decide possible indicators for their critical raw material needs.

7. **In a move to minimize costs of implementing a CE model** for the industry sector - industry data that is already captured and readily available through it's various reporting obligations (e.g. enviro/sustainability..) should be investigated & interrogated for use in appropriate composite indicator developments.

8. **Monitoring the performance of markets** in the recycling sector needs to enable any regulatory barriers and bottlenecks to be acted up quickly.

9. **Transparency and simplicity for communicating** in raising public awareness in the positive impacts being illuminated in production and consumption patterns as a result of the transformation to a CE.

10. **Data on the outcomes of implementing a CE** in Europe.. like indicators showing cost reduction, economic & enviro benefits, the scale of economic activities, social change, developments in progressive intelligent/smart infrastructure, human resource skillsets, and changes in business models needs to be made visible for the public and private sectors.

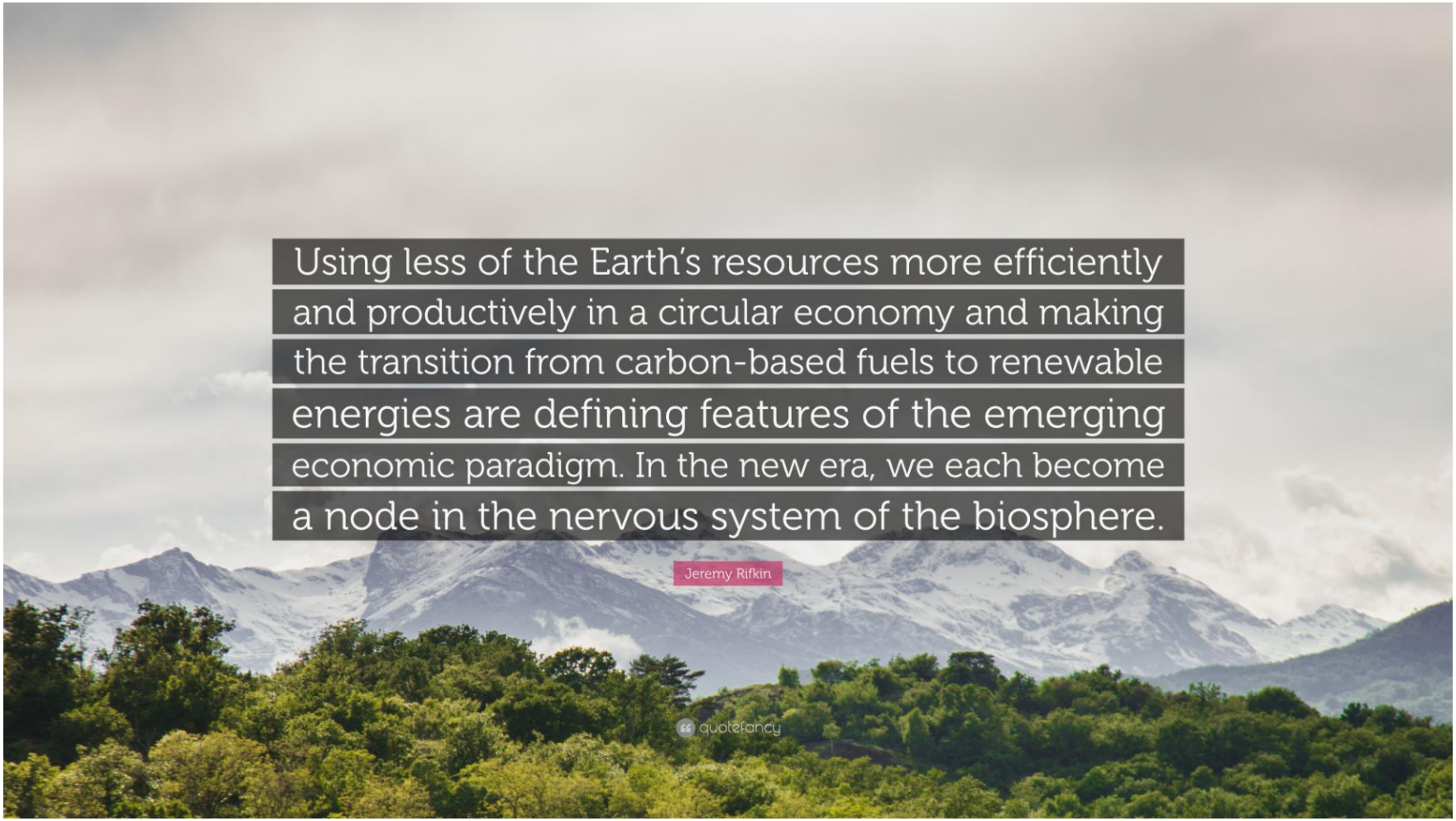
European Academies
easac
Science Advisory Council

Circular Economy = rethinking norms

I do not need a drill.

I need a hole in the wall

European Academies
easac
Science Advisory Council



European Academies
easac
Science Advisory Council

SIEMENS

European Academies
easac
Science Advisory Council

Ref: Critical materials report

- What is the problem we are trying to solve?
- Bottom line is that high technology has made us dependent on relatively small quantities of specific elements - not just on provision of bulk raw materials (iron, copper etc.)
- Also our future economic development is expected to depend on these areas - low carbon, information and communication technologies etc.
- So what solutions are required?