solace Northern Ireland

Department of Agriculture, Environment and Rural Affairs
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The Strategic Investment Board

nilga northern ireland local government association

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Briefing for Councils: Central-local Waste Management Discussions

The Future Management of Northern Ireland's Municipal Waste
'The World Has Changed'

Background

Further to the reform of local government on 1 April 2015, Waste management continues to be a key responsibility for local government and represents a significant cost risk. While the costs associated with waste management are subject to volatility, the expectation is that over time these costs will continue to rise.

Developing an effective cross-governmental, central-local approach to the **circular economy** will contribute to achieving the aims of the Programme for Government and will transform the way in which waste is managed by recognising and realising the true value of waste as a resource; the potential increased income generated helping offset costs to local government. This type of approach should provide wider economic opportunities for the private and third sectors, by supporting innovation, job creation and increased profitability across the industry. **An outline is provided in Appendix 3 of the council role in and examples of opportunities presented by the circular economy.**

Officers from councils and NILGA, together with officials from the former Department of Environment and Strategic Investment Board (SIB) have been meeting to consider the way forward on local government waste management service provision, further to local government reform and in the light of the recent 'Mills Report' on illegal waste activity and SIB studies on future infrastructure capacity requirements for Northern Ireland. Potential opportunities presented by the move towards a circular economy were also considered.

At an exploratory meeting on 7th July 2015, it was agreed to populate a strategic task and finish group with a small number of council Chief Executives and senior departmental officials to 'scope out' what is needed strategically for Northern Ireland in relation to waste management governance and delivery, leading towards the circular economy, and to produce a report to facilitate necessary action.

To this end, meetings have been held throughout January and March, with the aim of producing a report and action plan for SOLACE comment in May 2016, prior to 11 council and DAERA Board consideration and agreement. This Report and the Action Plan were presented to council Chief Executives for comment, prior to being presented to the relevant Department Board and the 11 councils for consideration and ratification.

The NILGA guide to Waste and Resource Efficiency provides detailed information on all of the issues under consideration. All councillors were provided with a copy of this guide in late September 2015, and an online version is available at http://www.nilga.org/Publications---Reports/Councillors-Reference-Guide-to-Waste-and-Efficienc.aspx

Summary of Trends and Key Issues

As the current waste strategy is coming to a close in 2020 - only four years away – there has been a dynamic and urgent consideration of the impending (2020) targets as part of a wider medium term context (to 2030). The Circular Economy as it applies to Northern Ireland and the implications of policy changes arising from the changing EU focus are key issues - as are the implications of recent SIB studies into the future infrastructure issues for Northern Ireland.

The recently published draft **Programme for Government Framework 2016-2021** has a stated aim of **'Improving wellbeing for all – by tackling disadvantage and driving economic growth".**

The approach recommended in this report and the accompanying action plan would contribute to achieving six of the 14 identified outcomes of the draft PfG, i.e.:

- We prosper through a strong, competitive regionally balanced economy
- We live and work sustainably – protecting the environment
- We are an innovative creative society where people can fulfil their potential
- We have more people working in better jobs
- We have high quality public services
- We connect people and opportunities through our infrastructure

The delivery of the accompanying action plan to achieving these outcomes could be measured in terms of contributing to 11 of the 42 identified PfG indicators. Only two of these 11 indicators are related to environmental sustainability and recycling, with the other nine linked to increased economic prosperity and employment. **Given the impact that the recommended action plan will have on the local economy, the Department for Economy and InvestNI have been identified as key partners as this work develops.**

Northern Ireland Trends

- Waste tonnages are on the rise again
- Recycling rates are starting to plateau
- Tonnages going to landfill continue to fall
- Volume of Refuse Derived Fuel being exported is growing year on year in absence of indigenous infrastructure
- Waste crime has distorted the local market
- NI is unlikely to meet the revised Waste Framework Directive target of 50% recycling by 2020 on the current trajectory
- Proposed EU Circular Economy targets will only heighten the need for infrastructure and increased recycling

Current Operational and Governance Context for Local Government

- Arc21 has been reconstituted as a body corporate, with a live procurement process. It can be noted that arc21 was advised by the DOE in a letter dated 15th of December 2015 that they had referred the planning application for the Residual Waste Treatment Project to the Planning Appeals Commission (PAC). The PAC held a pre-hearing meeting, on the 9th of March 2016 at which time it was established that a full hearing would commence on the 11th October 2016.
- It is therefore appropriate, and required under arc 21's Constitution, that due consideration be given by the constituent councils to the relevant issues to enable a fully informed decision to be reached. Each constituent council is to fully consider the available options for the next steps in relation to the planning application for the Residual Waste Treatment Project. A process has been put in train for this. Five of the six councils have approved the continued process of reviewing the decision. This process will not be concluded until all the six constituent councils have made their decision.
- It should also be noted that arc 21 has stated that there are legitimate grounds on which to request a hearing and that the pursuit of a hearing would be consistent with the Waste Management Plan and the legal commitments made by the predecessor councils in arc21, and as:
  (i) the need for public waste treatment infrastructure still remains;
  (ii) it will enable due process to be completed in line with stakeholder reasonable expectations; and (iii) it mitigates Councils exposure to liabilities

- The North West Region Waste Management Group (NWRWMG) is continuing to operate as a voluntary joint committee, less one of the legacy councils. Derry City & Strabane and Causeway Coast & Glens are currently assessing current contracts and collaborative issues

- SWaMP 2008 was dissolved. The three new councils in that area (Mid Ulster, Fermanagh & Omagh, and Armagh City, Banbridge & Craigavon) are yet to fully determine how they should collaborate on waste either formally or informally, with discussions underway.

- There are currently 3 Waste Management Plans covering Northern Ireland. The arc21 plan, which covers 6 new Councils, has been determined by the Department and has been ratified by 5 of the 6 Councils. The NWRWMG plan has been submitted to the Department for determination. A plan on behalf of the 3 former SWaMP 2008 Councils has also been submitted to the Department for determination.

- The DOE former Minister noted that his preferred option for delivery in Northern Ireland would be regional collaboration through a Single Waste Authority.

- The existing governance arrangements will need to be reviewed and evolve over time, and transitional arrangements are likely to be necessary. It is vital that governance structures are clear, simple and accountable.

What happens if we carry on as we are?

- Economic and job creation benefits from taking a circular economy approach to waste management will not be realised, and optimum economic growth models will not be achieved.
- Opportunities to develop new products and services, maximising the resource potential of materials, will not be realised to the same degree locally.
- The cost of waste management treatment and disposal will increase in light of the trends highlighted above, as landfill supply ends and export increases.
- Economic, employment and environmental benefits of provision of local 'energy from waste' infrastructure will not be realised.
- Foreign Direct Investment will not be maximised as there will be an infrastructural and institutional deficit in relation to treating and managing waste as a resource.
- Councils will be exposed to continuing risk as a result of illegal waste activity.
- Councils could be exposed to the risk of EU infraction fines.
- Even if the UK leaves the European Union, councils could be exposed to local sanction for non-compliance with domestic legislation.

Summary of Task and Finish Group Work

The Group firstly considered the outcomes that Central and Local Government will need to deliver both in the shorter term (up to 2020) and in the medium term (up to 2030) should the proposed EU Circular Economy Package be adopted by member states. **Current and projected future targets for recycling, recovery and landfill are set out in Appendix 1. A glossary of terms and acronyms is attached at Appendix 2.**

There are short-term and long-term challenges arising from:

- **the need for** culture and behaviour change, better public understanding, driving up quality and quantity of recyclates, service improvement/transparency, government help/intervention
- **the impact of** local, island-wide and global markets, consistency of collection and sorting practices, level of government support, planning and funding cycles, shipping Refuse Derived Fuel elsewhere, changes arising from EU circular economy policy
- **the need for** better information/intelligence, better collaboration, better regulation, better monitoring, changes to food waste collection arrangements

A major challenge arising from the developing policy on the circular economy is the likelihood of the introduction of **highly ambitious new targets** for reducing landfill waste down to 10 per cent by 2030, while increasing recycling capacity to 65 percent over the same period.

A key implication of this challenge will be an increase in the amount of recoverable waste. **A Strategic Investment Board preliminary assessment of the Circular Economy proposals has indicated that Northern Ireland is likely to require a thermal treatment capacity of around 600,000 tonnes and potentially up to 800,000 tonnes per year – *which is two to three times the current estimated need.*** At present there is no appropriate thermal treatment infrastructure in place locally, and we are exporting waste for recovery in the form of Refuse Derived Fuel. **It should be noted that even if the EU Circular Economy package is not implemented in the UK (e.g. due to a 'Brexit') the levels of illegal waste activity indicate that the current need would be in the region of 200,000 to 300,000 tonnes.**

The Group agreed that it would be preferable to treat this recoverable waste within close proximity of the 11 Councils (potentially including cross-border working), assessing the requirement for development of energy from waste infrastructure beyond that already planned. This was recognised as one of the key challenges facing both Central and Local Government.

Draft Action Plan (attached at Appendix 4)

A Draft Action Plan has been developed jointly by central and local government to set out a framework, designed to identify the mechanisms necessary to ensure Northern Ireland meets the relevant targets set for 2020 and beyond. The draft action plan notes *who* should lead on *what*, and by *when*; it is intended that implementation of the action plan will establish the *how*. The plan will assist in providing the evidence to support bids for funding.

Funding

It will be vital to the future success of this programme, to ensure adequate funding is put in place. The action plan includes 'ball park' estimates for specific actions, but **does not** identify potential sources of funding. **The identification of 'lead bodies' for actions in the plan should not be taken to indicate the source of funding.**

The estimated funding requirements set out in the plan are for indicative purposes only at this stage and will be firmed up as the actions in the plan are agreed and scoped out in greater detail.

It must be emphasised that some of the costs indicated are very much 'spend to save' initiatives, and will realise further efficiencies and savings over time.

Based on meeting the future shorter and longer term targets, the Group created a Central-Local Action Plan predicated on 4 delivery and 2 supporting outcomes. These are to:

1. **Minimise municipal waste.**
2. **Achieve the 2020 target of recycling 50% of household waste and prepare to contribute to meet a 65% municipal waste recycling target by 2030.**
3. **Maximise recovery and use of energy from residual waste in Northern Ireland.**
4. **Ensure provision of sufficient landfill capacity in Northern Ireland.**
5. **Develop a new delivery model to manage Northern Ireland's municipal waste.**
6. **Create a new procurement strategy to deliver outcomes 1-4.**

Supporting issues

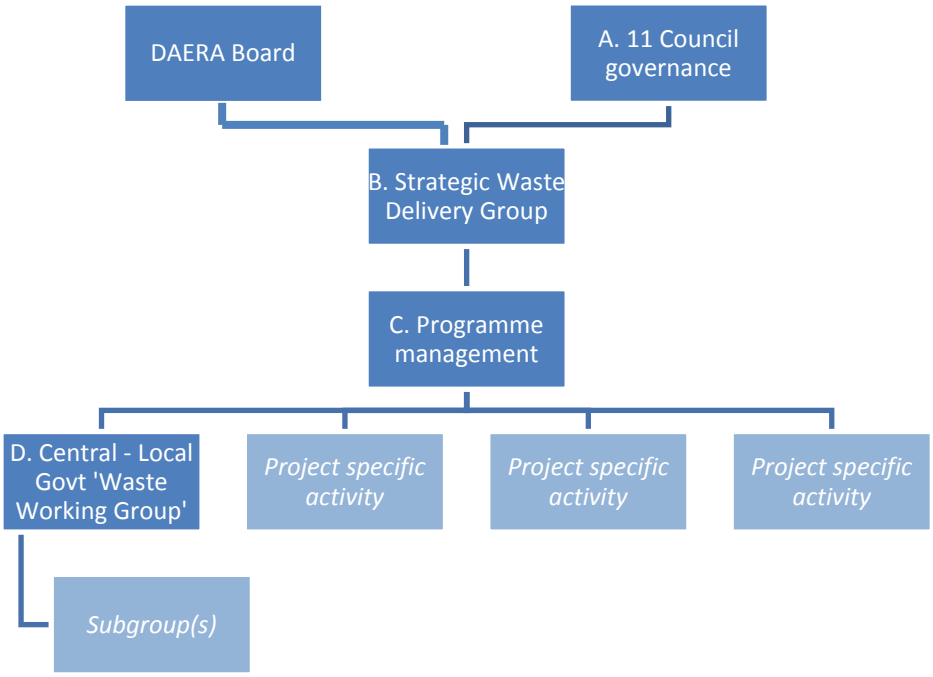
Support is required for implementation, in the shape of provision of appropriate governance, infrastructure capacity and effective procurement. Options in relation to all of these issues require consideration. Delivery structures should be clear, simple and accountable.

Eventual solutions to deliver what is required for 2020 and beyond will need to be agreed and supported by the 11 councils. An adequate 'run-in' period and government support will be required in relation to policy and contracting changes.

Recommendations

1. Funding sources for the implementation of the Action Plan must be identified and agreed as a priority. Early estimates are required to inform council financial planning cycles, and a cost-benefit analysis must be considered at an early stage.

2. If the Central-Local Action Plan is agreed, a new Programme Delivery Mechanism will need to be established and adequately resourced, to take forward its implementation. This will require consideration of existing governance and operational structures, as a forward-looking structure is created, designed to streamline activity and focussing on delivery of the Action Plan. A diagram of the suggested mechanism is provided overleaf.



The central-local working arrangements will need to be given detailed consideration, to ensure the optimal structure is set in place for delivery.

A. Format to be agreed by councils
B. A strategic waste delivery group will be the driver for this work, comprised of senior officials from councils, DAERA, Department for the Economy and SIB, reporting to and consulting with the 11 councils and the DAERA Board.
C. Programme Management level - responsible for the day to day operation of the programme. Likely to require extra resource in its own right with potential candidates drawn from central or local government or indeed from elsewhere.
D. Existing central-local operational working group

What is Northern Ireland required to achieve? Summary of targets - Appendix 1

RECYCLING
By 2020, we MUST ensure that 50% of household waste is recycled. **Current position: 43.6%** of waste from households was recycled in 2014. (The UK reports to the EU on waste from households, which excludes street sweepings and waste from public recycling bins). **Most of the 'quick wins' have been achieved. It will be a challenge, with current practices, to meet the 2020 target. After 2020, if the Circular Economy Package is implemented, targets are extremely likely to become even more of a challenge.**
By 2025, it is likely that we will be required to ensure that 60% of municipal waste is recycled. This is likely to include a target for recycling of 65% of packaging waste
By 2030, it is likely that we will be required to ensure that 65% of municipal waste is recycled. This is likely to include a target for recycling of 75% of packaging waste.
RECOVERY
By 2020, it will be necessary to ensure that 70% of non-hazardous construction and demolition waste is recovered. This is of limited impact to councils**.**
By 2030, it is likely that we will be required to recover around 25% (~600,000 – 800,000 tonnes) **of municipal waste, i.e. through recovery of energy from waste.** **Current Position:** In 2014/15 **14.9%** (142,000 tonnes) of local authority collected municipal waste was sent for recovery. Identified capacity requirements recently increased to 200,000t – 300,000t to deal with illegal waste activity.
LANDFILL
By 2020, we MUST ensure that no more than 35% of 1995 levels of biodegradable municipal waste goes to landfill, i.e. less than 429,000 tonnes. **Current position:** In 2013 **299,000 tonnes** of biodegradable municipal waste was landfilled
By 2020, the NI landfill allowance scheme will permit Councils to landfill no more than 220,000 tonnes of local authority collected biodegradable municipal waste **Current position:** In 2014 **229,000 tonnes** of local authority collected biodegradable municipal waste was landfilled
By 2030, it is likely that we will be required to landfill no more than 10% of the total waste arisings **Current position:** In 2014/15 **43.4%** of local authority collected municipal waste was landfilled. **Total waste arisings in 2030 will depend on the introduction and implementation of waste prevention targets.**

QUICK CALCULATOR
Assume that the amount of Municipal waste arising is 2m tonnes per annum (current very rough estimate). If we assume this remains constant until 2030, then the EU circular economy packages targets for 2030 translate into: <200kt in landfill (<10%); ~500kt for recovery (~25%) and 1.3mt for recycling (65%). **Given the likelihood of increased waste arisings due to economic recovery, the figure requiring recovery is more likely to be between 600,000 – 800,000 tonnes**

What happens if Northern Ireland doesn't achieve these targets?

Failure to meet EU targets is likely to result in infraction fines. These fines can be extremely heavy. Examples can be seen at: http://europa.eu/rapid/press-release_IP-06-1756_en.htm

Glossary of Terms and Acronyms - Appendix 2

As noted above, the NILGA guide to Waste and Resource Efficiency provides detailed information on all of the issues under consideration. http://www.nilga.org/Publications---Reports/Councillors-Reference-Guide-to-Waste-and-Efficienc.aspx

Waste from Households:	Household waste excluding street sweepings and public recycling bins
Household waste (HHW):	waste from households plus street sweepings and waste from public recycling bins
Local Authority Collected Municipal Waste (LACMW):	Waste collected by Councils (mainly HHW but will include some commercial waste)
Local Authority Collected Biodegradable Municipal Waste (LACBMW):	The biodegradable fraction of LACMW
Municipal Waste:	Waste from households and other similar waste – this includes most Commercial and Industrial waste – regardless of who collects it
Biodegradable Municipal Waste (BMW):	The biodegradable fraction of Municipal Waste
Commercial and Industrial (C&I) waste:	Waste from premises used wholly/mainly for the purposes of a trade/business, sport, recreation/entertainment
Construction, Demolition and Excavation waste:	Waste from construction or demolition works, including waste from any preparatory works
Refuse Derived Fuel (RDF)	Fuel produced from waste through a number of processes such as mechanical separation, blending and compressing to increase the calorific value of the waste. Such waste derived fuels can comprise paper, plastic and other combustible wastes and can be combusted in a waste-to-energy plant, cement kiln or industrial furnace.
Circular Economy	A circular economy means re-using, repairing, refurbishing and recycling existing materials and products. What used to be regarded as 'waste' can be turned into a resource. The aim is to look beyond waste and to close the loop of the circular economy. All resources need to be managed more efficiently during their life cycle
Residual Waste	The fraction of waste remaining after the source separation of e.g. food and garden waste, packaging, paper and paperboard, metals, glass. It is usually unsuitable for high quality recovery or recycling.
Recycling	The process of transforming materials into raw materials for manufacturing new products, which may or may not be similar to the original product.
Recovery	Options for recovering value from the waste stream. May include recycling and composting, thermal and biological treatments that use waste to produce energy.
Proximity Principle	The principle set out in the EU Framework Directive (91/156/EEC) whereby member states should establish a network enabling waste to be disposed of in the nearest appropriate installations, by means of the most appropriate methods and technologies to ensure a high level of protection for the environment and for public health.
Self Sufficiency Principle	The EU and its member states should remain self-sufficient with regard to the disposal of waste. As with the proximity principle most waste should be treated and managed within the region in which it is generated provided there are no unacceptable adverse effects. The principle of regional self sufficiency cannot always be rigidly applied given that commercial considerations may override boundary issues.

The Council Role in the Circular Economy - Appendix 3

How can councils use their waste management activities to create jobs and innovative new businesses locally?

Councils have a number of vital roles in maximising the opportunities presented by the **circular economy,** including:

1. As custodians of resources that can be diverted from disposal, and put to effective use as raw materials for new products in innovative or traditional businesses – creating jobs for citizens and growing the economy; or as fuel to create energy – both power and heat – which can be used to the benefit of citizens.
2. As promoters and supporters of new businesses and job creation in their areas.
3. As purchasers of goods and services.

A number of examples are outlined below, which demonstrate the circular economy in action. Five international business models and new ways of thinking are also outlined which could be encouraged by councils to develop in Northern Ireland.

We need to move from a system of waste to a system of resource stewardship—and from a linear economy to one that's circular. Some councils and their local businesses are getting closer to this ideal than others.

A council that is applying the principles of the circular economy could potentially benefit their local economy, community and environment in a variety of ways. There are huge opportunities for councils to increase the number of jobs and employment opportunities in their areas, for example:

Retail and Services: Through targeting an area, potentially a more run down part of the town centre, where there could be a focus on reuse and 'upcycling'; **for example**, a street full of antique shops, vintage fashion outlets, furniture restorers, auction houses and artisan producers using recycled materials (e.g. handbags from old car seat belts). This could be supported by council marketing activity and, possibly, local powers to apply discount to local non-domestic rates (in partnership with the NI Department of Finance).

Manufacturing Job Creation and Skills Development: By using their 'clout' as 'market-makers', councils can create a policy and operational landscape which encourages collaboration with the private sector or social economy to provide a stream of materials through a variety of recycling streams (i.e. domestic, commercial, etc) for use as raw materials in recycling and reuse businesses, and through the local development plan, zoning for enterprise and light manufacturing in areas of high unemployment/social deprivation. Such areas could also be supported by novel business rating schemes.

For example, *Ulster Supported Employment Limited* (USEL) provides training and supported, paid employment for people with disabilities and health related conditions and is based in Cambrai Street, close to an 'interface area' in North Belfast. USEL has recently started working with councils to take mattresses for recycling. They secured a contract with Belfast City council to remove all mattresses from their four

amenity sites and to recycle them. So far they have collected and recycled in excess of 3500; total weight of slightly over 60 tonnes.

- 39% of this tonnage is sent to the mainland for reuse in carpet underlay and acoustic matting
- 15% went for reprocessing (Metal Springs)
- 40% went to Energy from waste
- Only 6% went to landfill

The USEL medium term strategy is to offer this service to all councils within a 30 mile radius of Belfast and follow this up next year to offer this service to all councils within Northern Ireland. So far 4 jobs have been created, with another 6 forthcoming with the 30 mile radius roll-out.

Use of Council Contracts to Change the Marketplace: As purchasers of goods and services, councils can lead the drive towards a circular economy through the specification of contracts and use of environmental and social impact criteria.

For example, as part of capital programmes; when agreeing a 'new build' project, the council should begin to look at the whole life for the project – how to increase employability and skills in the initial build, how to incorporate the use of recycled materials in the build, to take a look beyond the first use and explore the potential for refurbishment or reconstruction in the longer term, and the potential for eventual recovery of materials used.

The International Picture

Since the Industrial Revolution, humanity's use of natural resources has been basically the same:

The World Bank's predictions for *global* waste generation are chastening: on current trends **it will double between now and 2025 to 6.5 million tons of solid waste every day**. Yes, we are better at using virgin resources more efficiently while second-hand markets and recycling rates have both improved; but this hasn't altered the fundamentals. Many companies' business models are not set up to do much else than earn money from volume. The fact that few businesses are vertically integrated makes it more difficult for businesses to reform the model for "closed" product loops even if their CEOs want to.

When you add to this the OECD's estimate of **an extra two billion middle class consumers before 2030**, commodity price volatility and new environmental regulations, you start to see the scale of the challenge. The good news, though, is that **circular economy thinking—building an economy that doesn't create waste**—can make business sense. This is particularly important in an era of such fast changing technology.

It often requires product vendors to think of the resources in their products as assets rather than inputs and their customers as users rather than buyers.

The question then becomes how to maximize value along the chain and, crucially, how to enable the assets to be continually re-introduced to markets.

For example, 3D printing is usually perceived as being used to create plastic moulds; however, increasingly it is being applied as a manufacturing technique for other items such as concrete construction materials or, more recently, using recycled steel filings as a raw material, requiring much less energy than production of new steel.

Once a material is seen as an *investment* and customers as *users*, one appreciates how little business-sense it makes to discard product assets after only a few months instead of maintaining the customer relationship during multiple cycles.

Of course, this "circular" thinking may be easier said than done. There are five fundamental considerations for nearly every sector when thinking about how to make their business model more circular:

- How can we design our products with asset recovery in mind?
- How can we develop product lines to meet demand without wasting assets?
- How can we source material in regenerative loops rather than linear flows?
- How can we develop a revenue model that protects value up and down the chain, and
- How can we get our customers to cooperate with us?

Complex organizations with multiple stakeholders and relationships with customers that are generally "point-of-sale" may need to change their mind set and think of themselves as service providers.

Outlined below are five examples of business models that are contributing to making circular businesses a reality[1]:

1: Products as Services

This is where goods vendors embrace the idea of themselves as service providers: leasing access to and not selling ownership of a service. In some cases this has led not only to an effective hedge against cost volatility but also to a more loyal customer relationship and increased 'upsell'. **Vodafone's trade-in service** is a good example. You can rent the latest phone for a year and keep on exchanging it for a newer version. With Vodafone engaged in collecting the old phone, not only does this act as material collection and pooling but from a business standpoint also creates deeper customer relationships.

2: Next Life Sales

Next life materials and products work when a company can efficiently recover and re-condition its products after use and then put the same products into the market to earn a second or third income. Mercedes Benz Ireland is a good example here. It's more than a second hand car parts dealership. Parts are refurbished in Mercedes Benz workshops and then undergo a certification process. These high quality safety-checked parts are offered at up to 50% cheaper than new and with the same manufacturer's warranty as a new part.

[1] www.fastcoexist.com

Mercedes-Benz genuine reconditioned parts are subject to the same quality requirements as their new parts. They are worked on by experts and brought fully up-to-date in technical terms, so that they again meet the high standards of Mercedes-Benz with regard to reliability, safety and durability.

3: Product Transformation

Not all products can be reconditioned in their entirety but most products have certain components that carry a high value. Not just products, but often materials themselves have an embedded energy component that makes them even more valuable than their virgin source. With the right design and remanufacturing capabilities, they can be put together to form new products. This is product transformation. For example, **Caterpillar**, a large employer over a number of sites in Co. Antrim, is a world leader in remanufacture, attracting nominations for global awards. Caterpillar has been providing remanufacturing services for more than 20 years, and the European Remanufacturing Centre of the Caterpillar remanufacturing Services Division is located in Shrewsbury, England. Using a host of remanufacturing technologies, the facility receives engines and a range of other components from customers, and cleans, refurbishes, reassembles and updates them in compliance with the exacting standards set by Caterpillar. The site remanufactures thousands of items each year, bringing significant environmental and cost benefits to Caterpillar and third-party customers.

4: Recycling 2.0

Not to be forgotten is that innovation in recycling technology (Recycling 2.0) is rapidly evolving and enabling production of high-quality products with fantastic sustainability performance. **Starbucks**, for example, is actually aiming to turn thousands of tonnes of its waste coffee grounds and food into everyday products by using bacteria to generate *succinic acid* which can then be used in a range of products from detergents to bio-plastics and medicines.

5: Collaborative Consumption

Lastly, social media exchange platforms are rapidly transforming industries by collaborative consumption. **Airbnb** (the online service that matches people seeking vacation rentals with hosts who have space) now has over 200,000 listings in 26,000 cities. The leading businesses that are advancing the concept of the "sharing economy" are in many respects no longer insurgents and newcomers. The size and scale of **Uber**, Airbnb and several other firms now rival, or even surpass, those of some of the world's largest businesses in transportation, hospitality and other sectors. As the economic power of these technology-driven firms grows, there continue to be regulatory and policy skirmishes on every possible front, across cities and towns spanning Europe, the USA, and beyond. AirBnB and Uber are now operative in Northern Ireland, and councils will need to consider how to work with them effectively and maximise the benefits of their presence in the NI marketplace.

Mixed Business Models

Of course, moving to a truly circular economy could require a mixture of all these five business models and a great deal of product and service innovation.

For example, nationally – and locally in Northern Ireland - www.TerraCycle.co.uk has developed a collaborative approach to dealing innovatively with hard to recycle materials in partnership with the private sector and the public; with markets for items such as used coffee pods, biscuit wrappers, and cigarette waste.

"TerraCycle offers free recycling programmes funded by brands, manufacturers, and retailers around the world to help you collect and recycle your hard-to-recycle waste. Simply choose the programs you'd like to join; start collecting in your home, school, or office; download free shipping labels; and send us your waste to be recycled. You can even earn rewards for your school or favorite non-profit!"

What these business models demonstrate is that it is possible to rethink how we make and use things. The companies that are starting now may well define the future of sustainable business, enabling global prosperity on a crowded planet with finite resources.