



## Case Study: Aquafil Group

The distinction between two different materials cycles is at the core of the circular economy concept. Materials, either technical or biological, remain in their respective cycles, becoming resources for another process. This idea of materials in flow is key in moving away from the current take-make-dispose model.

This is easier to grasp for some materials. Many metals, once recovered, can be smelted and re-used at a consistent quality. Mycelium packaging is a biological material that when disposed of, can biodegrade and improve soil quality. Other substances are more difficult, and the cycling of plastics represents a real challenge.

Plastic is ubiquitous. Work has been done to recycle it through chipping, but this tends to affect the performance of the polymer, and could be classed as downcycling (1). But some companies are making progress in cycling these polymers at parallel quality, for example Aquafil Group. The Ellen MacArthur Foundation spoke to CEO Giulio Bonazzi to learn more about the company and its move to a closed-loop model.

For over 40 years, Aquafil Group have been operating in the production of Nylon 6, with a primary focus on manufacturing fibres used in carpet flooring, but also with experience in engineering plastics and synthetic apparel fibers. CEO Giulio Bonazzi explained that Aquafil have been re-processing Nylon 6 for some time now, but most recently the success of the Econyl project has represented the biggest progress in the move towards the closed-loop production of Nylon 6.

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### Aquafil Group: closed-loop timeline

1969 - Established in Trento, Italy

1971 - Polymerisation and nylon fibre production begins

1993 - Tessil 4 is incorporated in Cares, will become centre for reprocessing BCF fibres

2006 - New BCF spinning and reprocessing facility opened by Aquafil USA, and an 8.8MW Cogeneration plant at Arco plant

2007 - Plant for reprocessing and marketing fibres in Southeast Asia and Australia is opened

2009 - Aquafil Solaris is incorporated, two 1MW solar fields built

2011 - First Econyl plant opened in Slovenia

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The system enables the company to take waste &#8211; either post-industrial, created in the chemical production of nylon 6, or post-consumption, products owned by the client or user at the end of life &#8211; and manufacture new nylon 6 with no loss of quality.

Aquafil's main priority in developing a more circular business model has been cost. Mr Bonazzi states frankly that the virgin materials and energy inputs that his company uses are increasing in price, and therefore if they can use less of them in the manufacture of a product that is still appealing to the client, then it is easier to operate a profitable business.



**Cost is a very important part. I could tell you very nice stories, but I believe that being sustainable is not only a nice thing to do, or about making the working environment satisfactory for our workers...the first rule in being sustainable is being profitable, because if you are not profitable as a company, sooner or later you go out of business, and yes, you aren't damaging the environment - but also you don't exist anymore.**

So Aquafil are leading their customers &#8211; after years in working with Nylon 6, Mr Bonazzi knows what his customer requires, and is now working to be able to continue to provide this in the long-term.

Aquafil have a strong heritage in effective resource management. For over twenty years, the company have been working on re-processing BCF (carpet yarn), and Mr Bonazzi says that &quot;without realising it we have always developed technologies that are very advanced in terms of environmental concerns&#8230;and looking at business in a circular way has opened up new opportunities for innovation". It can be seen elsewhere that it takes time for a globalised company to develop the necessary skills, products, business models and systems to move towards at circular model. Having operated in reprocessing their product for two decades, Aquafil are now truly discovering the potential of a closed-loop process.

## **Seizing a materials opportunity**

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Warehouse where the waste is prepared for depolymerisation

© Aquafil

The move to Econyl is the next logical step in this line of innovation. However, there is tendency to overplay the link between ‘innovation’ and technology, when in fact Aquafil are realising the benefits of a closed loop model right now, without relying on radical jumps in technology, or waiting for a revolutionary ‘silver bullet’ for the textiles industry.

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**When my father created the company in 1969, he certainly didn't have in mind the idea that nylon 6 is fully recyclable, he chose nylon 6 because of other reasons. A few years ago when we started to consider the move to a circular model we tried to understand what kind of technologies were available to implement to get there. It's not enough to create a nice product, but it is about creating a system that works. And we realised that Nylon 6 has these peculiarities, it can be depolymerised, and once this has been done with strong purification, then we can produce a product with exactly the same characteristics of the polymer coming from crude oil. We were lucky to be part of this system already, but we have invested money to develop technology that supports it.**

Mr Bonazzi is referring to processing plants, and also the creation of the Econyl Reclaiming Programme, an essential tool that the company is putting in place to facilitate a reverse supply chain and ensure reliable materials inputs. Furthermore, the programme not only enables clients to return their end of use products, but sources a variety of products made entirely or partially of nylon 6, such as fishing nets, rigid fabrics, clothes at the end of their life cycle, or other plastic components. The company's thinking has shifted &#8211; what used to be thought of as waste is now food for their industrial process.

By using an existing fibre currently in heavy circulation around the world as a substitute for expensive

virgin materials, Aquafil is re-designing and optimising an existing system to ensure the long-term prosperity of the company. This means accounting for energy inputs as well, and with Italy facing some of the highest energy costs in Europe, Aquafil are investing in renewable sources &#8211; two 1MW solar photovoltaic fields in Puglia, and an 8.8 MW cogeneration plant at Arco.

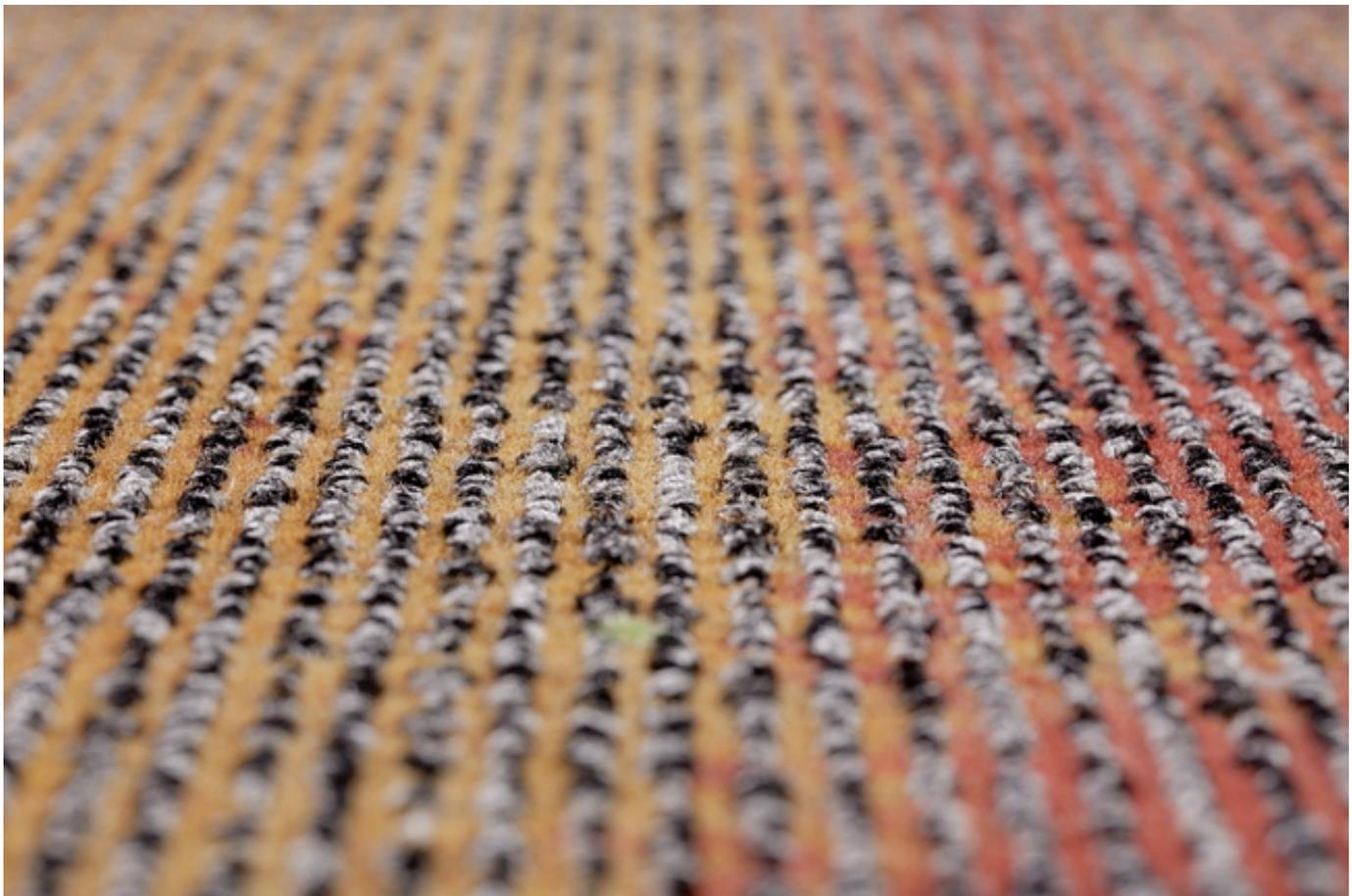
## Regenerating a 'waste' material

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Aquafil publications refer to the Econyl process as recycling, but Mr Bonazzi explains that this shouldn't be confused with the downcycling that takes place in some other industries.

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**Our recycling system is quite complex - it's not like recycling PET bottles - we are not simply remelting bottle flakes as the vast majority of PET recyclers are doing, but we are practically regenerating the waste material we use. From a certain perspective, we could start with an inferior product and we could make a higher quality product.**



Carpet flooring made with Econyl yarn

© Aquafil

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In manufacturing Econyl, Aquafil are actually regenerating the material, maintaining or increasing the

quality of the product. In a world that is often aiming for ‘zero’ &#8211; zero waste, zero emissions, zero carbon &#8211; it is refreshing to hear that Aquafil are aiming to be waste positive. Not only does the Econyl project divert waste from landfill, but it turns this waste into a high-quality yarn with a variety of uses.

## "It's not a matter of technology"

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Although this is clearly not a side project, and Econyl will form ‘a fundamental pillar’ in Aquafil’s development in coming years, Mr Bonazzi knows that there is “always room for improvement”. Again, it isn’t necessarily technological advance that will make this possible:

**“The problem is how long the market takes to organise and to supply us with a high enough quantity of feedstock. It's not a matter of technology, this already exists today. If the market organises quickly we can respond quickly. I believe in 10-15 years represents a feasible timeline.**

While legislation could help, especially in forming barriers to sending end of life materials to landfill, Mr Bonazzi believes there are more effective ways that governments or international bodies could help companies like Aquafil. He identifies a lack of awareness of the potential of ‘waste’ as an obstacle to the transition to a fully circular business model. Although Aquafil have a significant market share and global reach, in terms of publicity, the company still has a limited voice.

**“We are not such a large company, and the cost of advertising is expensive, so the EU could help us in the communication that this possibility exists. In the past there has been legislation that should force fishermen not to throw fishnets away, but this activity was not giving any value, it was easier to throw them in the sea. Today we can pay for these materials. Better communication and collection of the materials could help us.**

This understanding of waste as a resource can also open up feedstock opportunities in waste streams in other industries. Although not a leader in the clothing sector, Aquafil have been working to process clothing with high nylon content, such as swimwear.

It is not unique technology, legislative change, or financial levies that have enabled Aquafil to shift towards a circular business model. By seeing value in existing waste in an unoptimised system, the company have seized a materials opportunity. With a promising reverse logistics programme and increasing renewable energy inputs, Aquafil are ensuring that key factors are in place to secure the long-term prosperity of the company.