Competitiveness of corporate sourcing of renewable energy

Annex A.1 to Part 2 *of the Study on the competitiveness of the renewable energy sector*

Case study: WWRD

ENER/C2/2016-501
28 June 2019

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Table of Contents

1 Introduction

WWRD is a **small manufacturer of luxury crystal glass tableware products** based in **Ireland**; as a key part of its business model, the company is a **'tourism factory'** that allows tourists to visit its manufacturing plants in Waterford and learn more about the production of crystal glass. In compliance with its corporate social responsibility (CSR) strategy, WWRD purchases **100% of the electricity consumed via a green energy offer**. The company has also assessed opportunities to rely on renewable sources for heating purposes; however, for the time being, WWRD decided not to pursue such opportunities. By focusing on a medium-sized company, which is environmentally conscious, this case study allows drawing some policy recommendations that may foster small and medium-sized enterprises (SMEs) to embrace the green energy revolution.

2 Sector

According to the NACE (Rev.2) statistical classification of economic activities in the European Union (EU), glass tableware producers belong to the "other non-metallic mineral products" group and are included in the class 23.13 covering the **manufacture of hollow glass**, i.e. packaging (or container) glass and domestic glass (tableware and giftware). Based on data provided by the European Domestic Glass association, about **35 glass tableware plants are based in the EU**. This population includes both very large producers (e.g. Arc) and small plants (e.g. WWRD) producing either crystal or jewellery.

Hollow glass has been used as packaging in many aspects of everyday life since ancient times. The main products of the hollow glass sector are bottles (e.g. for wines, sparkling wines, beers and ciders, soft drinks and mineral water), jars (e.g. for jams, milk products, sauces, oil and vinegar) and other containers (e.g. flacons for perfumery, cosmetics and pharma), which come in different colours and shapes in order to achieve additional features. As mentioned, besides packaging, the hollow glass sector also includes **tableware and giftware**, e.g. drinking glasses, pitchers, dishes, bowls, centrepieces, barware and decorative objects. The two categories of products are quite different when it comes to production costs, revenues, value-to-weight ratio and international trade, which is considerably higher for glass tableware, thus making these products globally tradable.

Usually, the **production of hollow glass** involves five main stages:

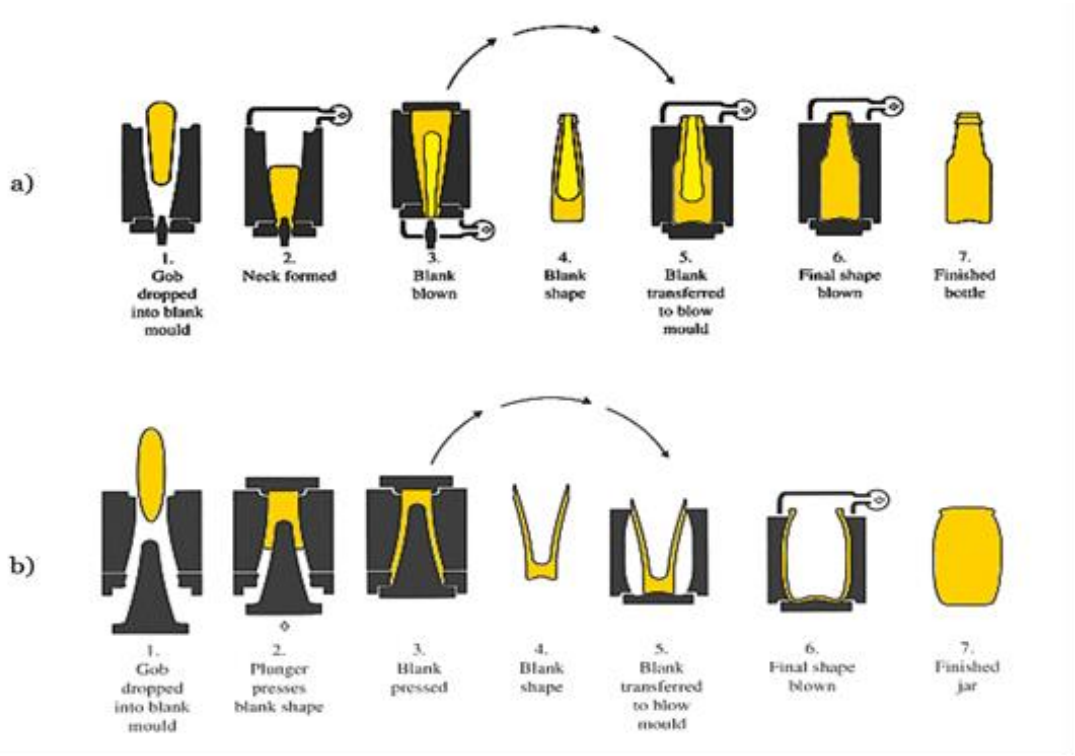
- **Preparation of raw materials**. The raw materials employed depend on the kind of glass produced, e.g. soda-lime glass, borosilicate glass. Raw materials mixed in a batch plant together with "cullet glass", i.e. recycled glass. As cullet melts at lower temperatures, it reduces natural gas and electricity consumption as well as CO_2 emissions.
- **Melting and refining**. The batched raw materials are introduced in a furnace where they are melted down at around 1,500°C; operating continuously, furnaces have an investment life between 10 and 15 years. It takes approximately 24 hours to convert a batch of raw materials into molten glass and to refine it to remove any bubbles, after which it is conveyed to the forming area. Furnaces can be natural gas heated or electricity heated; some furnaces rely on heavy oil or, more recently, on oxy-fuel.
- **Forming**. In automated plants, having been conditioned by careful temperature control in the forehearth, i.e. a channel-like structure fired by a number of small burners, the molten glass enters the feeder and flows through holes in an orifice

plate. Streams of glass are cut into gobs of a predetermined weight, which are then guided into individual moulds. In the first stage, the gob of glass falls into a blank mould to produce the so-called parison. Depending on the kind of product, hollow glass is formed through two different two-step processes.

- In the blow-and-blow process, used for narrow-neck containers, e.g. bottles, compressed air is blown into the molten gob to create a cavity while this is in the blank mould. The result is a hollow and partly formed container, which is subsequently subjected again to compressed air to blow and mould the final shape.
- The second process, known as the press-and-blow method, is generally used for jars and tapered narrow-neck containers. Here, a metal plunger instead of air is used to press a cavity into the gob in the blank mould before compressed air is used to form the container in the blow mould.

In glass tableware plants applying a more traditional production process, the forming stage usually relies on the so-called 'glassblowing' technique, which consists of inflating molten glass into a parison with the aid of a blowpipe. The parison is then manipulated on a smooth stone or iron surface (the so-called 'marver') to obtain the desired shape.

Figure 1 Schematic illustration of the blow-and-blow (a) and press-and-blow (b) processes for forming hollow glass



Source: www.cyberglasstrade.com

- **Annealing and (on-line) coating**. The formed hollow glassware is removed from the mould and usually transferred to a temperature-controlled tunnel to cool down in a controlled manner. In other words, annealing consists of a heat-treatment meant to relieve internal stresses, prevent uneven cooling and ensure mechanical stability; this process might take up to two or more hours depending on the glass

thickness. While still in the tunnel, the external surface is first coated with a thin layer of tin oxide to increase its strength. Eventually, before leaving this phase, the product is also coated with polyethylene wax to protect the surface and prevent scuffing.

- **Inspection and secondary processing**. The hollow glassware undergoes visual inspection by high-resolution camera equipment and/or by trained specialists. Rejected items are sent to the recycling operation to be turned into cullet and re-enter the production process. Before packaging, inspected items may undergo secondary processing such as sculpting and/or engraving.

3 Company

WWRD is a **medium-sized company** based in Ireland, which operates in the glass tableware sector. More specifically, WWRD is a provider of luxury glass tableware products, including full crystal glass. In this respect, while most of the glass tableware producers are currently relying on automated production, WWRD still applies a very **traditional, labour-intensive production process**, thus acting as a leader in a niche market, whose consumers are mostly based in the United States (US).

Figure 2 Production of glass tableware at Waterford

Source: WWRD

Nevertheless, this market is changing quite fast, as the quality of crystal glass produced by automated plants is improving; this puts downward pressure on market price and margins for hand-made crystal glass. Therefore, WWRD is also a retailer of glass tableware and offers a factory tour. More specifically, the WWRD manufacturing plant is a so-called **'tourism factory'**, i.e. a working factory that allows tourists to visit production lines and learn more about traditional crystal glasswork. WWRD hosts more than **200,000 visitors per year**. In the recent past, this activity has become part of WWRD core business; therefore, the company produces glass tableware items

only during visiting hours, rather than via a continuous flow process. In fact, at night, molten glass drawn from the furnace is not formed and becomes cullet to be reinserted in the furnace[1].

4 Country

WWRD operates in Ireland, a country where in 2017 renewable energy (RE) accounted for about 11% of the gross final energy consumption.[2] While most of the renewable electricity was generated from wind, in line with data registered in other EU countries, the lion's share of the production of RE for heating and cooling purposes relies on bioenergy. With the sole exception of the wood and wood products sector, most of the industrial and service sectors in Ireland have a very low renewable energy sources (RES) utilisation (well below 20%). In particular, RE represents about 15% of the final energy consumption of non-metallic minerals (e.g. glass) producers. Based on interviews conducted with national stakeholders in the context of this Study, **self-generation** by corporates seems to be a quite uncommon option to source renewable electricity. In the same vein, up to the end of 2018, no **RE power purchase agreement (PPA)** was signed yet. In addition, guarantees of origin (GOs) can be only cancelled by electricity suppliers, thus leaving no room for companies to rely on **unbundled GOs**. Therefore, **green energy offers** seem to be the main option for corporates to purchase renewable electricity.

5 Energy use

In the EU, **electricity costs** represent more than 6% of total production costs borne by a typical glass tableware producer; **natural gas costs** are about 8% of such production costs. In terms of energy consumption per tonne of output, the EU glass tableware sector is a **gas-intensive** one, consuming about 5.5MWh/tonne of natural gas and 1.3 MWh/tonne of electricity. The electricity consumption of a typical plant ranges between 17,000 and 51,000 MWh per year; natural gas consumption goes from 45,000 MWh to 240,000 MWh per year.

Against this background, it is apparent that **WWRD is not a typical glass tableware producer**. The company owns two small installations in Ireland: a site for batch preparation, polishing, packing and distribution, which is located outside the city of Waterford; and a site for manufacturing and retailing, which is in the city centre.

The manufacturing site relies on a small **cold-top electric furnace**, which is recommended by the most recent EU Best Available Techniques (BAT) Reference Document for the Manufacture of Glass, as it has minimal emissions. This is a very important requirement for a 'tourism factory', based in the city-centre and hosting hundreds of visitors per day. The company uses about 3,500 MWh of electricity per year in total: about 70% of this electricity is consumed by the furnace, the remaining 30% is used by machinery (e.g. air compressors) as well as by the ventilation/extraction system, which is pivotal to ensure a suitable environment for both workers and visitors. **All the electricity used by the two sites comes from RES**. More specifically, WWRD relies on a green energy offer. As the production process is labour-intensive and the plant produces luxury tableware products, electricity costs represent less than 1% of total production costs.

Although the production of glass tableware items is discontinued outside visiting hours, **the electricity consumption profile of the company is quite flat** as the

[1] In this respect, the plant reuses a share of cullet in the production process much larger than a standard glass tableware plant.
[2] For further details, please see Eurostat (2017), Summary results – Short Assessment of Renewable Energy Sources, available at: https://ec.europa.eu/eurostat/web/energy/data/shares

very same amount of molten glass is constantly drawn from the furnace at any time, night and day. This is due to the specific design of the furnace, which makes very inefficient any interruption of the melting process. In fact, to turn on this type of furnace, natural gas is needed to start converting a batch of raw materials into molten glass; once the electrodes are covered by the molten glass they start working and generating heat as the electricity is conducted by the molten glass itself. The temperature inside the furnace is then kept very stable both to allow maintaining a cold layer on top of the batch material (the distinctive feature of a cold-top furnace) and to preserve the fused-cast refractories used to line the inside wall of the furnace, which can be permanently damaged by thermal shocks.

WWRD relies on **natural gas for the annealing process as well as for space heating**. Whereas typical glass tableware companies perform the annealing process in a temperature-controlled conveyor tunnel, WWRD relies upon a fixed oven, which is maintained at a constant temperature during the day, loaded at the end of the day and activated only during the night. For the time being, WWRD does not rely on biogas or other types of RES for heating and cooling purposes. Natural gas costs represent a small share of the overall energy costs and about 0.02% of the total production costs.

6 RE procurement method and technology

As mentioned above, WWRD sources renewable electricity via a **green energy offer**. This is a standard offer, which does not rely on a specific type of GOs. In this respect, the company trusts the Commission for Regulation of Utilities and believe their commitment to purchase green grid electricity translates in more investments in renewable generation. The same supplier serves the two production sites owned by WWRD. The electricity is purchased via a **three-year contract**; this seems to be the maximum contract period offered by electricity suppliers in Ireland at a fixed price.

By contrast, **the company does not rely on RE for heating purposes**. Reportedly, biogas is not available in the gas distribution network where the plant is connected. Similarly, WWRD cannot use waste heat to pre-heat the batch and cullet because the small electric furnace does not allow for it; in addition, raw materials are pre-mixed in a site different than the one when the furnace is installed. WWRD considered the option to recover waste heat generated by the air compressors used in the production process; however, required investments entailed a too long payback period.

7 Benefits

WWRD purchases renewable electricity via a green energy offer primarily to improve the **environmental sustainability** of its business. This is an easy-to-source option contributing to increasing the value of the company, as most of the investors are gradually refocusing their investment strategies on sustainable businesses. In addition, it may increase the demand for WWRD products in the coming 15 years, as also consumers are increasingly showing concern for the environment; in this respect, glass is well positioned to **meet consumers' demand for green products**, as it is entirely recyclable. For the time being, however, WWRD achievements in terms of renewable electricity are advertised only on the company website, rather than on the packaging of WWRD products because **consumers do not show yet the necessary willingness to pay a premium price for green crystal glass**. The overall CSR strategy applied by WWRD is set by the Fiskars Group, to which the company belongs. The entire group aims to a 30% reduction in energy consumption and a 50% reduction in CO_2 emissions (both direct and indirect) by 2027, compared to 2017. Reliance on green electricity allows WWRD to meet the CO_2 emission target. The company is also reviewing its supply chain (upstream), especially when it comes to chemical products,

to improve the overall sustainability of the production process and minimise environmental hazards.

The price in €/MWh paid by WWRD for green grid electricity is largely equivalent to the price the company would pay for conventional electricity. Reportedly, this is because, to foster the liberalisation of the electricity market, tax advantages were granted to new entrants, which are mostly green energy suppliers. **The current green energy offer does not allow to reduce the operating costs** of the company, which at any rate are only marginally affected by electricity costs (representing about 1% of the total production costs). As mentioned above, the specific contract signed by WWRD also ensures **price stability**, as the price is fixed for a three-year period.

Finally, while **for the moment WWRD does not rely on biogas**, the company believes that, with an economy based largely on agriculture, Ireland may have a competitive advantage to generate cheap biogas to be injected into the national gas grid. This would both reduce energy costs and CO_2 emissions for gas-intensive businesses and increase the energy independence of the country. As both plants owned by WWRD in Ireland are very small, they are not covered by the EU ETS system; therefore, RES for heating and cooling purposes do not directly contribute to regulatory compliance. However, alternative measures may be imposed in the future by the Irish government to reduce CO_2 emissions of small players.

8 Costs

Green energy offers represent an **'easy-to-source'** (e.g. finding offers and contracting) and 'low risk' option to embrace the green energy transition. This option is particularly appealing for small consumers of electricity. In fact, WWRD performed an overall assessment of their energy consumption profile and **discarded the option to self-generate electricity** due to the expected payback period (which appears to be too long) and high electricity demand (which cannot be met via e.g. rooftop solar photovoltaic). Interestingly, **unbundled GOs are not an option for Irish companies**, as they can be cancelled only by energy suppliers.

When it comes to RES for heating and cooling purposes, as mentioned **biogas is not available in the network to which the WWRD plants are connected**; in addition, it seems to be more expensive than natural gas. The company has specifically assessed the opportunity to use **waste heat from their air compressors** to preheat the lubricating water used in hand cutting; however, the **payback period of this option is too long**, as some investments are required to adapt the current equipment and allow for waste recovery.

9 Policy recommendations

Small energy consumers and, especially, SMEs usually prefer investments with relatively short payback periods. In the absence of public support, this reduces the appeal of self-generation, especially in countries with sub-optimal weather conditions for solar photovoltaic. In the same vein, the **long-term contractual commitment required by RE PPAs** may discourage SMEs from entering such agreements. In addition, in a country such as Ireland, so far RE PPAs were not an interesting option for both generators (who relied on public support schemes to install RE power plants) and off-takers (as GOs for supported projects cannot be transferred to buyers). In this context, WWRD confirmed that green energy utility offers are the best option to source renewable electricity in Ireland for the time being. In this respect, the **national energy regulator** plays a pivotal role to increase trust in the green electricity market and ascertain that the increasing demand for green energy offers by corporates translates into **additional investments in RES in Ireland and the EU**.

Long payback periods may also affect the uptake of RES for heating purposes in Ireland. In fact, whereas there are a number of support schemes providing grants or loans to households for investing in solutions for renewable heating, no support scheme is available for companies. **Public support** would allow companies such as WWRD to invest in solutions to recover waste heat and, in turn, reduce energy consumption for heating purposes. Finally, it seems that the **market for biogas for industrial uses** is still underdeveloped in Ireland, especially if one considers that agriculture plays a central role in Ireland's economy. In this respect, WWRD would consider purchasing biogas, if distributed in the current gas grid with no additional connection or transport costs.

CASE STUDY

WWRD, Ireland

Source: WWRD (2019)

WWRD, Ireland

Overview

Company

- Medium-sized company producing luxury glass tableware, including full crystal glass + 'tourism factory' allowing tourists to visit production lines
- Traditional, labour-intensive production process
- Cold-top electric furnace
- Two sites:
  - Batch preparation, polishing, packing and distribution (outside the city of Waterford)
  - Manufacturing and retailing (in the city centre)

Energy use

- Electricity consumption = about 3,500 MWh/y, flat consumption profile
- All the electricity used comes from RES
- Electricity costs = less than 1% of total production costs

Procurement method

- Renewable electricity sourced via a green energy offer
- Electricity is purchased via a three-year contract at a fixed price
- No RE for heating purposes

Overview

Costs

- Self-generation is unsuitable: long payback period and too high electricity demand
- Unbundled GOs can only be cancelled by energy suppliers
- Biogas is not available in the network to which the WWRD plants are connected
- Payback period for using waste heat is too long

Benefits

- Green energy offers:
  - Environmental sustainability
  - Easy-to-source and low-risk
  - Price stability: fixed price for 3 years
- Biogas (potential benefits):
  - Environmental sustainability
  - Reduction of CO_2 emissions

Policy Recommendations

- The national energy regulator may play a pivotal role to:
  - Increase trust in the green electricity market
  - Ascertaining that the demand for green energy offers translates into additional investments in RES
- Investment support would allow to invest in solutions to recover waste heat and, in turn, reduce energy consumption for heating purposes
- Biogas could be an option if distributed in the gas grid, with no additional connection or transport costs