



**GILKES**  
Hydro

**HYDRO OPPORTUNITIES FOR ENERGY RECOVERY IN THE WATER INDUSTRY**



## GILKES: POWER RECOVERY BACKGROUND

Gilkes has provided hydroelectric turbines to the water industry for either generating electricity or direct driving pumping equipment, which can then be used in pumping stations, treatment works, and station service supply at reservoirs or storage dams. Many turbines have been supplied to water treatment plants or water utility distributors having a dedicated water supply and conveyance network. Gilkes involvement covers the supply of new turbine equipment, refurbishment of old turbine equipment, servicing and maintenance, modernisation, and the handling of turnkey water-to-wire contracts.

## REDUCING COSTS

In many applications, the Gilkes Turgo impulse hydro turbine in place of a pressure relief valve, or PRV, will generate sufficient electrical power to operate the majority of the onsite plant processes. If not all, it would certainly make a considerable contribution and allow for the offsetting of purchased power from an electrical utility. A hydropower system in such an application has the huge advantage as there is a constant, and known volume of water in the system at any one time. This enables both the costs and the return on investment to be accurately calculated. There is also the possibility of the plant being entirely independent in generating its own electrical supply, which requires “black start” capability, and can be incorporated easily at the design phase of the project.

## APPLICATIONS

### Water Treatment Works – Power Recovery

Water entering a plant for treatment is passed through a Gilkes turbine, providing power for either onsite use or export to the grid. Plant flow control is paramount and when a Gilkes Turgo impulse turbine is utilised, water will always continue to flow via the use of the deflectors, whether or not power is being generated.

### Direct Pumping Applications

Water enters a treatment plant with sufficient head to drive pumps, providing treated water to holding reservoirs or directly into the distribution system.

### Waste Water Treatment Works

Where sufficient head is available for treated water as it leaves the treatment plant, power can be generated at the point of return to the river.

### Compensation Water

To provide power using mandated compensation flow rates to rivers, stream etc. for fish stability and environmental habitats.

## ► Water Treatment Works – Power Recovery

### Power generation at the pressure relief point at the inlet to Water Treatment Works

One of the largest costs associated with the treatment of water is electrical power. Water arrives at the plant either from a reservoir or distribution network, invariably of a pressure too high for the treatment plant to operate at. This problem is usually solved using a pressure relief valve, where the excess energy in the water is dissipated and often converted as heat.

Gilkes has considerable, worldwide experience of paralleling pressure relief valves with a Turgo impulse turbine. The use of a Turgo impulse turbine does not result in the plant using losing any flow control. The turbine is configured so that its primary purpose is to provide the facility with the exact volume and pressure required for the downstream processes. One of the great advantages of a Turgo impulse turbine is that it generates over a very wide flow range, enabling it to ramp up and down as needed to supply the downstream demand of the system.

The Turgo Impulse turbine therefore provides three functions:

- Energy dissipation
- Flow control
- Power recovery



## ► Direct Pumping Applications

### Power generation using direct pump drives by water turbines

There are specific applications for this type of power recovery with turbine outputs and speeds being specifically matched to pump characteristics. Often there is a motor coupled into the system to provide the shortfall of power when insufficient water is available.

Care must be taken in matching the pump and turbine characteristics to create a direct drive system which has a significantly higher efficiency than an intermediate generator and motor type arrangement



## ► Waste Water Treatment Works

### Power generation using treated waste water at the outlet to the works

This form of power recovery is not always recognised as a common one, owing to the proximity of waste water treatment works to a river or sea. There is also usually a very low head differential between the two, making substantial power generation difficult (power being equal to flow multiplied by head). However, using Gilkes Francis turbine technology and working off heads as low as around 10 meters, power generation is very much achievable.

Flow rates vary so it is necessary to have a regulated turbine utilising a governing system. Power can be consumed either at the treatment works itself, or exported to the grid. In either scenario, revenue is created by consuming the power behind the meter reducing electrical bills, or sold to a utility under a power purchase agreement.



## ► Compensation Water

### Power generation using compensation flows to rivers from reservoirs

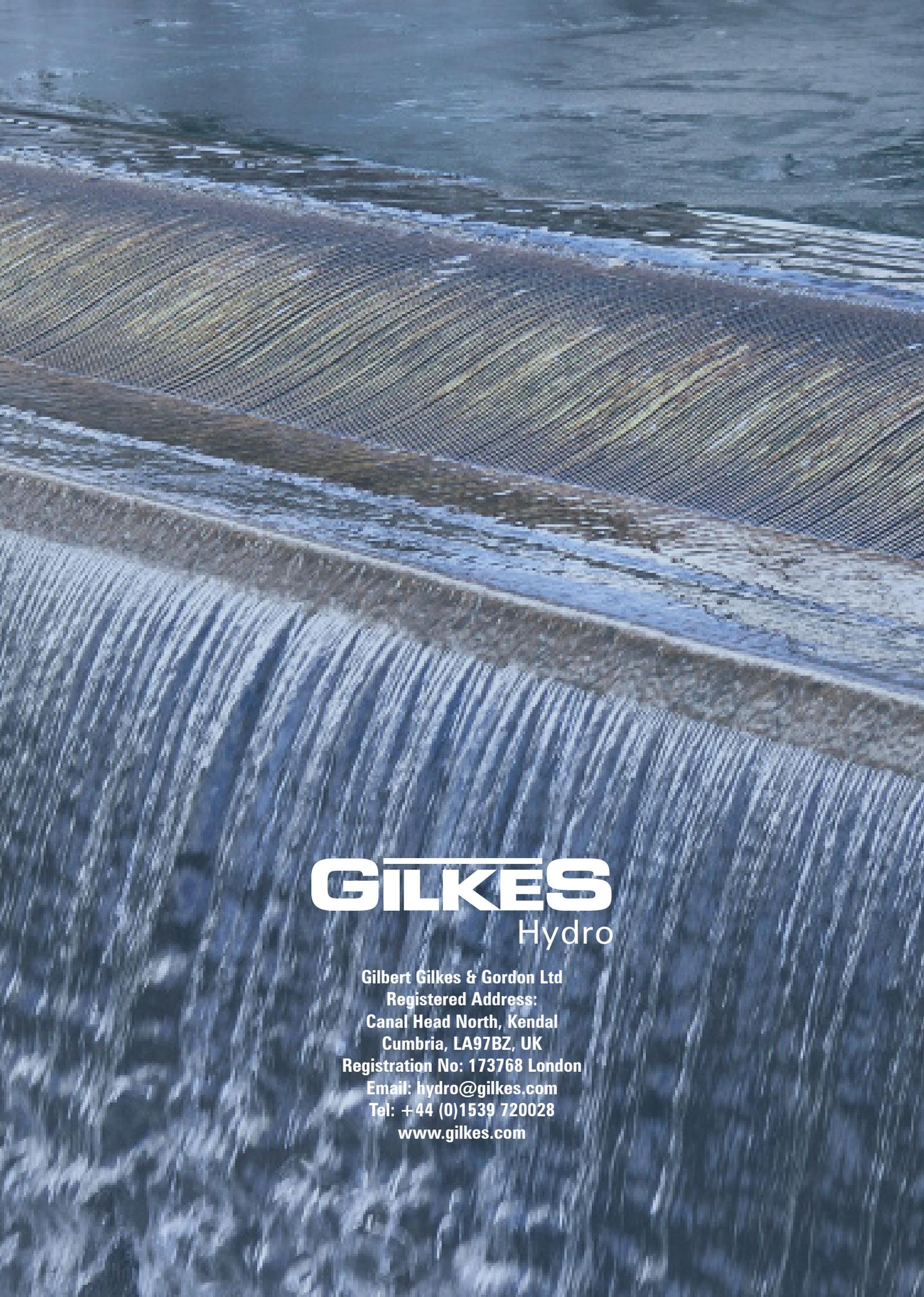
This is a traditional form of power recovery at reservoirs and to some extent at treatment plants where water has to be returned to a river to satisfy a minimum flow regulation.

For these applications, there is a mandated flow of water available. The power derived from this type of generation can be used to either drive motor driven pumps at the plant, or to directly feed into grid distribution system.

Induction units are often a suitable choice due to their off-the-shelf availability and lower cost, with the power being exported to the grid. Synchronous generators with governing systems enable use in an isolated or islanded mode, and have the ability to provide power to the treatment plant, regardless of whether the incoming grid is available or not.

Turbines can be grid connected for power export, can run islanded to provide electrical power to the plant when no grid is available, or a combination of both. Consuming the power on site reduces plant costs and leads to an accelerated return on investment.





# **GILKES** Hydro

**Gilbert Gilkes & Gordon Ltd**  
**Registered Address:**  
**Canal Head North, Kendal**  
**Cumbria, LA97BZ, UK**  
**Registration No: 173768 London**  
**Email: [hydro@gilkes.com](mailto:hydro@gilkes.com)**  
**Tel: +44 (0)1539 720028**  
**[www.gilkes.com](http://www.gilkes.com)**