

## CASE STUDY

### LAKE GRANBY, NORTHERN COLORADO, USA



#### KEY STATISTICS

**Customer:** Northern Colorado WCD  
**Turbine type:** G150 Francis  
**Number of Turbines:** 2  
**Power (kW):** 580kW (Each)  
**Net Head:** 210 ft  
**Flow:** 38 cfs  
**Dia:** 450mm  
**Speed:** 900 rpm  
**Date of Commissioning:** May 2016

#### SCOPE OF SUPPLY

**2 Gilkes 450mm G150 Francis Turbines.**  
**Generator** - 645 kVA, 60hz, 3-Phase, 900rpm with roller bearings.  
**Generator Controls & Switchgear** - PLC based fully automated controls, Turbine Governor, Electrical Protection System, Station Services, DC Battery Back-Up System, MCC & Generator Switchgear  
**Hydraulic Control Modules**  
**Installation & Commissioning**

Situated on a turbine shaft centerline of 8,060 feet (2,457 meters) above sea level in Northwest Colorado on the West Slope of the US Continental Divide, Lake Granby is another successfully commissioned Gilkes project. As an integral part of Northern Colorado Water Conservancy District's (NCWCD) Colorado-Big Thompson Project, the new Lake Granby hydro plant is positioned to provide the District with revenue recovery for decades to come.

This is the second project for NCWCD where the United States Bureau of Reclamation (USBR) has granted a Lease of Power Privilege (LOPP) for energy recovery on existing USBR dam facilities. It is poignant as NCWCD has been the only organization so far to successfully execute projects under the LOPP program; having been granted two of the nine-total applications to date. The first, the Carter Lake project dedicated to Robert V. Trout, in Berthoud, Colorado also incorporated twin Francis turbines from Gilkes.

#### CONTACT

Email: [hydro@gilkes.com](mailto:hydro@gilkes.com) Tel: 01539 720028 Fax: 01539 732110  
[www.gilkes.com](http://www.gilkes.com)  
Gilbert Gilkes & Gordon Ltd, Canal Head North, Kendal, Cumbria LA9 7BZ. Registration No.173768 London

# GILKES

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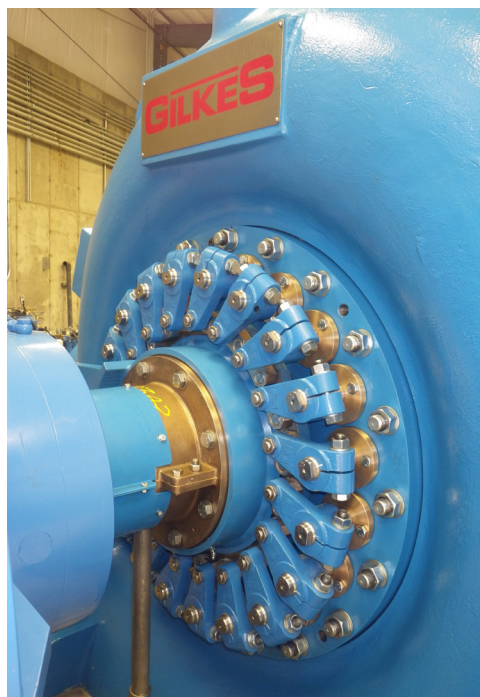
The fully automated and mostly unmanned plant consists of two, Gilkes 450mm G150 Francis turbines coupled to 900rpm synchronous generators; with each turbine having an electrical output of approximately 580kW, at the rated head and flow. The turbine runners utilized on this project are the enhanced high-efficiency runners that Gilkes Research and Development department, utilizing the latest CFD software, developed to increase the efficiency and power output of the runners. The turbine PLC controls, switchgear, DC back-up system, and the hydraulic control module were also part of the scope of supply, and were provided by Gilkes long-time vendors who have repeatedly provided equipment to, and have been part of many successfully executed Gilkes projects.

An important feature of the project was to have two, same-size Francis turbines to recover as much energy as possible under varying flow conditions; accommodating the changing flow releases NCWCD is required to deliver to the Colorado River. The plant is able to operate using a single turbine when the flow demand is lower, and to then have the ability to bring on a second machine automatically as the flow demand increases. The PLC software then balances the operation of both machines by sharing the flow equally, to ensure that the maximum energy output and efficiency is attained.

The control narrative, designed and developed by Gilkes was the basis of the PLC software which allows the machines to operate in a number of changing conditions. Either of the two machines can be brought online initially as the lead machine, both locally from the plant and also remotely from anywhere via remote access; with the other machine coming on when flow demands increase. In the event of a localized trip condition scenario on either of the machines, the PLC software automatically promotes the still-operating machine to be the lead, and will allow the tripped machine to automatically come back on, once the trip faults have been cleared and the machine is healthy to return to service. This approach ensures that the turbines are kept at the maximum uptime to ensure the potential energy recovery is as high as possible.

Thanks to the efforts of all involved the project was commissioned approximately 2 months ahead of schedule, allowing for the maximum energy recovery during the high flow-release months for 2016.

A few months into full operation following the full commissioning of the project, NCWCD's Project Manager, Carl Brouwer commented – "Granby continues to run successfully. No issues at all"



#### CONTACT

Email: [hydro@gilkes.com](mailto:hydro@gilkes.com) Tel: 01539 720028 Fax: 01539 732110 [WWW.GILKES.COM](http://WWW.GILKES.COM)  
Head Office: Gilbert Gilkes & Gordon Ltd, Canal Head North, Kendal, Cumbria LA9 7BZ.  
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