



DuPont™ Ultrafiltration Technology Yields 20 Percent Reduction in Operating Costs for GNPowr in the Philippines

FilmTec™ IntegraPac™ IP-77XP* Ultrafiltration Modules help power plant reduce energy usage, chemical costs and local water footprint to provide affordable electricity to growing community

The challenge

Sustained economic and population growth on the island of Luzon in the Philippines has created a surge in demand for electric power, driven largely by the island's rapidly emerging cities and its three Freeport Zones: Clark, Subic and Bataan. As a result, the Luzon electrical grid, including Manila, is projected to reach a peak demand of at least 11,200 megawatts (MW) in 2019.

Climate change also continues to impact the availability of freshwater throughout the Philippines. The increasing number of intense droughts has reduced water levels and river flows, and many freshwater coastal aquifers experience saltwater intrusion. Roughly 25 percent of coastal municipalities in Luzon are affected, and the situation is expected to worsen as sea level rises.

With a population of over 127,500, Mariveles is a growing municipality located on the southern tip of Luzon's Bataan peninsula. The GNPowr Mariveles Coal Plant Ltd. Co. (GMCP) is situated on the coast, where it can easily draw Manila Bay saltwater that is desalinated onsite to provide service water and feed water for the plant's subcritical boilers, turbines and generators. Operating since 2014, the 632 MW power plant has two identical 316 MW (net) power blocks that use pulverized coal combustion technology to provide electricity to several distribution utilities.

By sourcing seawater for the plant's service and feed water, GMCP minimizes impact on water from local aquifers, which is needed for agricultural, pastoral, commercial and residential purposes. GMCP also faces the challenge of keeping plant costs low in order to provide reasonably-priced electricity to the steadily growing economy of Bataan and central Luzon.

The plant's water treatment facility consists of six stages. Seawater first passes through a gravity filter with a Lamella plates, followed by a series of self-cleaning filters. The critical ultrafiltration (UF) phase is needed to prevent downstream fouling of the saltwater reverse osmosis (SWRO), brackish water reverse osmosis (BWRO), and demineralization stages. Failure to control fouling prior to these final purification stages can result in unreliable operations, frequent offline chemical cleaning and significantly higher energy consumption.

Fast Facts

Location: Mariveles, Philippines

End User: GNPowr Mariveles Coal Plant Ltd. Co.

Application: Power Generation

Technology: Ultrafiltration

Product Name: FilmTec™ IntegraPac™ IP-77XP*

Water Type: Seawater

Capacity: 221 m³/h

Commissioning: 2015

*now under IntegraTec™ brand

GMCP's plan originally specified 210 conventional UF membranes in three trains, which were installed during the power plant's engineer-procure-construct phase. Once operations began, the UF membranes operated at sub-optimal levels, and failed to deliver the rated capacity to feed the downstream RO and demineralization processes. Frequent fullblown and abbreviated cleaning of the UF membranes became necessary, resulting in low production and a high silt density index (SDI) of between 3.0 and 5.0.

GMCP faced four main challenges in resolving their UF replacement, including system compatibility issues, CAPEX costs, installation time and value-added support.

The solution

Following a thorough vetting process, the plant selected FilmTec™ IntegraPac™ IP-77XP* Ultrafiltration Modules because of their:

- Pre-engineered, standardized and ready-to-assemble skids. The technology is modular and scalable, making UF installation and start-up convenient and efficient.
- Innovative XP fiber, with up to 35 percent higher permeability than previous generation modules, to improve operating efficiencies and productivity.
- Compatibility with existing self-cleaning filter, and larger UF membrane area. This resulted in a lower UF system CAPEX with fewer UF modules needed – 132 UF modules versus 210.

Finally, in contrast to the other alternatives, DuPont's value-added services include:

- Engineering review, design and installation
- Installation of dosing system with injection quill
- Installation of VFD to reduce flow of backwashed water
- After sale technology service available locally

The benefits

Following the installation of FilmTec™ IntegraPac™ IP-77XP* Ultrafiltration Skids in the UF-1A train in 2015, flow capacity increased from 147m³/hour to 221m³/hour. The technology also reduced SWRO cartridge filter average monthly consumption by 81 percent from 2015 to 2019 (Fig. 1).

Even more dramatic, throughput prior to clean-in-place regeneration in the UF train improved by nearly 900 percent (Fig. 2).

There are many other benefits to the installation of the new UF modules. The higher productivity of FilmTec™ IntegraPac™ UF* membranes enabled GMCP to reduce the installed membrane area in the UF process train by 24 percent. Water production cost (Php/m³) in the UF trains was reduced from Php 1.46/m³ in 2015 to \$0.25 in 2019 – a reduction of 83 percent.

Advanced UF modules also provided significant yearly cost reductions in the SWRO, BWRO, and demineralization plant processes. In fact, after the first installation of DuPont™ UF skids in 2015, overall plant cost reductions in terms of chemicals and filter consumptions had improved by 35 percent by 2016. The third UF train was equipped with FilmTec™ IntegraPac™ UF* skids in 2017, resulting in an aggregate total plant cost reduction of 58 percent by 2019.

*now under IntegraTec™ brand

Fig. 1: SWRO cartridge filter average monthly consumption

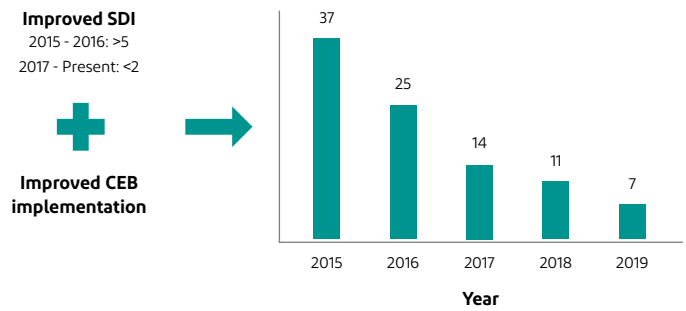
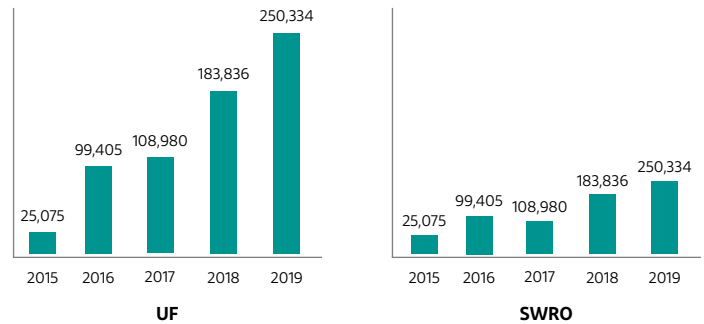


Fig. 2: Throughput prior to CIP/Regeneration



"We are pleased with the performance and impact of FilmTec™ IntegraPac™ UF modules. Plant operating costs are down, desalinization production is up, our water footprint is improved, and the cost of producing electricity for Bataan is significantly more affordable."*

Melchor Doroneo
Operations Manager, GNPower Mariveles Coal Plant Ltd. Co.



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