COMBUSTING RFO IN A COMMERCIAL BOILER
MEMORIAL HOSPITAL CASE STUDY

Improving energy costs and energy management is critical for operations of all sizes, so facilities are in need of solutions that are both economical and sustainable.

From 2013-2014, **Memorial Hospital**, a critical access, acute care hospital in New Hampshire, burned 140,000 gallons of No. 4 fuel oil to generate heat for the facility. Similar to diesel, No. 4 fuel oil is a heavy petroleum fuel that, when burned, adds greenhouse gas emissions to the atmosphere. In need of an alternate solution to reduce its carbon footprint, while maintaining heating efficiency and reducing cost, Memorial Hospital investigated options ranging from solid biomass to compressed natural gas. Ultimately, **Renewable Fuel Oil (RFO)** from Ensyn Fuels proved to be the best solution.

RFO: A RENEWABLE SOLUTION

RFO is a renewable fuel made from second-generation biomass feedstocks, such as waste streams from forest and agricultural sites, that have previously gone unused. RFO emits approximately **85% lower greenhouse gas emissions** than similar petroleum products and it has many additional benefits.

BENEFITS OF USING RFO

- Cost-competitive with petroleum fuels
- Long-term stable price for budget forecasting
- Made from sustainable, renewable Biomass residuals
- Storable and pumpable liquid similar to petroleum fuels
- Clean burning fuel without the sulfur and particulates from petroleum fuels
- Low greenhouse gas emissions
- Meets ASTM D7544 quality standards

IMPLEMENTING RFO AT MEMORIAL HOSPITAL

Because RFO is made from biomass, it has a slightly acidic nature compared with petroleum fuel, which requires modest changes to the fuel system, mainly in the pre-combustion section. The fuel train must be constructed of stainless steel, but in most cases, RFO can utilize existing post-combustion boiler equipment.

At Memorial Hospital, a 15,000 gallon above-ground storage tank was installed for fuel storage. This tank has a small footprint and fits strategically into the facilities section of the hospital.

A separate stainless steel fuel circulation system was installed for the circulation and delivery of RFO to the burners. Due to space limitations at Memorial Hospital, the pump system was built on-site, but it is usually provided



RFO Pump and Heat Exchangers

BOILER, BURNER AND FLUE GASES

RFO is a clean burning fuel, with very little sulfur or particulates so it doesn't require changing the flue gas equipment. Minor modifications will be required of the boiler burner and feed system, but usually the costs of these changes are easily recouped from the overall fuel savings.

In most cases, a boiler that burns fuel oil, natural gas or propane can be converted to burn RFO. For the installation at Memorial Hospital, Cleaver Brooks designed a drop-in burner that fit seamlessly with the boiler. This burner is capable of burning both RFO and No. 4 fuel oil, giving the hospital a fuel redundancy that did not exist prior to the conversion to RFO.



The Dual-Fuel Burner that can Burn both RFO and #4 Oil



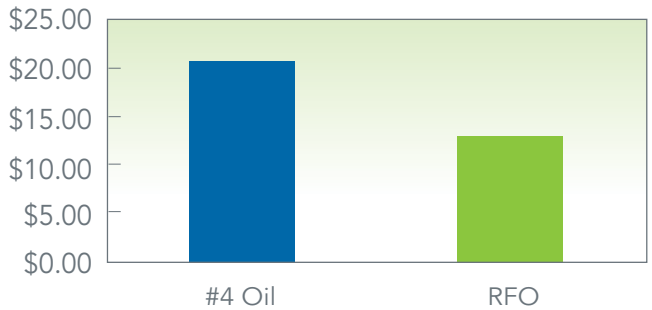
15,000 gallon storage tank

COST SAVINGS

Using RFO, from 2014-2015, Memorial Hospital will save approximately 37% compared with burning No. 4 fuel oil in the prior heating season. The hospital will also achieve stable, more predictable heating costs due to the stability in biomass costs compared with fluctuating crude oil costs.

The cost for the modest equipment conversions is captured in the price of the RFO, so savings are realized with no capital expenditure required from Memorial.

Fuel Costs - $/MMBtu

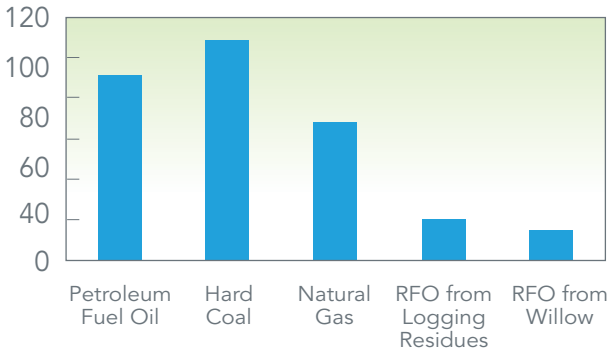


COMBUSTION EMISSIONS REDUCTIONS

RFO is made from renewable biomass that consumed carbon dioxide (CO_2) during its growing cycle. When burned, these same emissions are released resulting in zero net emissions, so the fuel is considered CO_2 neutral. Compared to fossil fuel oil in burner applications, RFO can reduce greenhouse gas emissions by approximately 85%.

At Memorial Hospital, the gross measured emissions will be reduced by 68% which also means that the emissions taxes paid to the state of New Hampshire will also be reduced by 68%. The majority of the reduction in emissions comes from the reduction in SO_2.

Lifecycle GHG Combustion Emissions



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