Smart tank storage solutions for new biofuel feedstocks

Mission-critical heat tracing systems and innovative tank insulation help tank farm owners with flexible, energy-efficient storage

Kees Oerlemans, Koen Verleyen and Pele Myers
nVent

Seismic change is on the horizon for the chemical storage sector. For many years, the industry has relied on oil production as its main source of new investment streams. In 2020, however, this well-established trend was challenged. As a result of the pandemic, worldwide oil production dropped from 100 million bpd to 88 million bpd – a downturn felt even more keenly by the US market, which fell by a staggering 20% (*Nagle*, 2020).

In the US, overall biofuels production capacity – which includes renewable diesel, biodiesel, ethanol, and other biofuels – reached 23 billion gallons per year (gal/y) in January 2023, a 6% increase in total production capacity from January 2022. Fuel ethanol accounted for 78% of US biofuel production capacity, renewable diesel and other biofuels accounted for 13%, and biodiesel accounted for 9% (*EIA*, 2023).

While both demand and production levels have risen sharply (*IEA*, 2021), this dramatic shift is likely a sign of the market developments to come. The increasing move to renewable feedstocks and the consequent need for storage of both fossil products and renewable products are driving demand for additional tank storage.

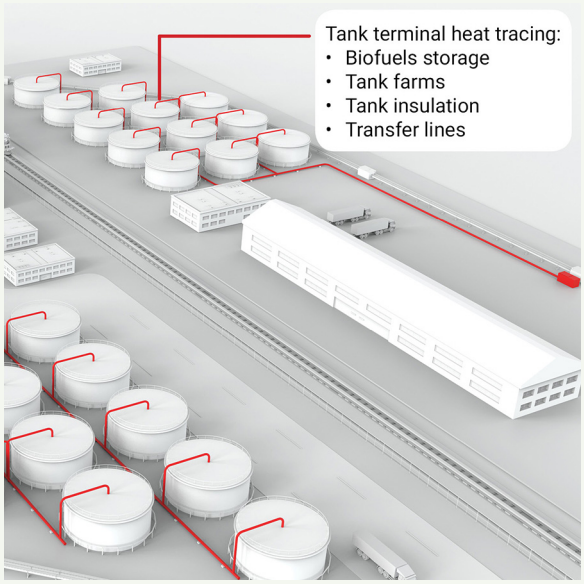
With mounting pressure from governments to reduce reliance on fossil fuels and limit global warming to below 2°C in line with the Paris Agreement, crude oil's position as the primary growth driver for the tank storage sector seems set to change permanently (*Davies, et al.*, 2020).

Shifting focus

The growing demand for electric vehicles and other carbon emission reduction initiatives have led to some facility owners choosing to repurpose their existing oil refining infrastructure for renewable energy production (*Davies, et al.*, 2020).

As the petrochemical market pivots to focus on high-quality, high-margin chemical feedstock products, investment in tank storage sites are growing, as evidenced by global organisations, including Vopak and Ineos, announcing major new sustainability-focused storage projects in the past year (*Vopak, 2021; Ineos, 2020; Ineos, 2020b*).

New growth opportunities are now opening up for tank farm operators. To take advantage, though, owners will have to contend with a range of evolving challenges, from storage flexibility demands to improving energy efficiency and taking site safety to the next level. Smart heat tracing systems, paired with the



Biofuels production at a smart tank farm

MATERIALS Jacket*		
Aluminium	.024 in (0.6 mm)	
Stainless steel	.016 in (0.4 mm)	
Coated steel	.024 in (0.6 mm)	
*Jacket material can be coated for corrosive environments and coloured for aesthetics		
Insulation		
Polyisocyanurate	K = .19 BTU • In/Hr • FT • °F	Tmax = 250°F (121°C)
Fibreglass	K = .24 BTU • In/Hr • FT • °F	Tmax = 850°F (454°C)
Mineral wool	K = .26 BTU • In/Hr • FT • °F	Tmax = 1,200°F (649°C)
Cellular glass	K = .30 BTU • In/Hr • FT • °F	Tmax = 900°F (482°C)
Calcium silicate	K = .34 BTU • In/Hr • FT • °F	Tmax = 1,200°F (649°C)
Expanded perlite	K = .34 BTU • In/Hr • FT • °F	Tmax = 1,200°F (649°C)
K-factor based on 100°F (38°C) mean temperature, per manufacturer data sheets.		

Table 1 Trac-Loc materials table

latest tank insulation strategies, can empower tank farm owners to navigate these issues with confidence and establish technologically advanced, safe, and sustainable sites that will shape the future of the chemical sector.

Quick setup, easy scale-up

To keep up with current demand – and the opportunities it presents – tank farm operators need heat tracing and insulation systems that can be installed quickly. However, to ensure the site can remain agile, scalability should also be a core concern.

Standing seam insulation panels can be made from one or more industrial insulating materials. Jacket materials come in a wide range of colours and conform to industry standards (see **Table 1**).

Unlike traditional systems, standing seam insulation panels are prefabricated off-site while the tank walls are being raised at the facility. This means the insulation can be installed immediately following tank construction without the need for scaffolding. The panels can be easily lifted into place with a cherry picker or hanging basket.

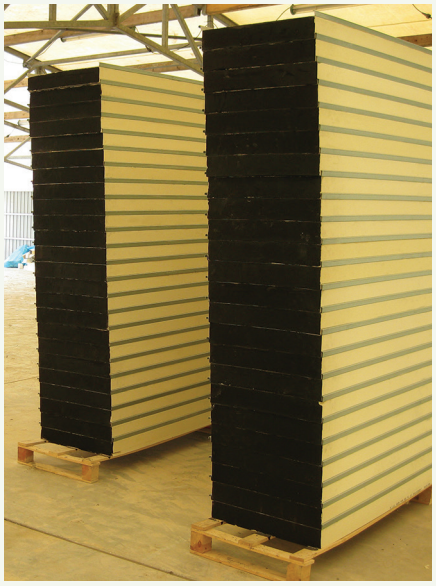
To further fast-track the installation process, the latest smart heat tracing systems feature intelligent hazardous area control panels that can be installed in the field close to pipe circuits, as opposed to a central control room. Based on nVent Raychem internal design and power distribution comparisons of executed projects 2015-2020, this seemingly simple feature can reduce the heat tracing system's power infrastructure and communications cabling requirements by 20% or more for lower total installed cost and faster installation. In addition, smart heat tracing controllers allow site owners to easily incorporate new piping circuits as their facility expands by seamlessly integrating the new local controllers with the existing control system.

Smart heat tracing systems Elexant 4010i

Keeping environmental costs down

Energy efficiency and the reduction of carbon emissions are fast becoming primary concerns for chemical producers when selecting a tank storage

Certified cables are placed around the tank. Stainless steel clips fixed on this cable are captured within the seam made between two panels, resulting in a mechanically superior system with inherent expansion and contraction properties.



Prefabricated panels are stored in containers or a warehouse on site.

Panels are installed easily and quickly by using a hanging basket or cherry picker, eliminating scaffolding requirements.

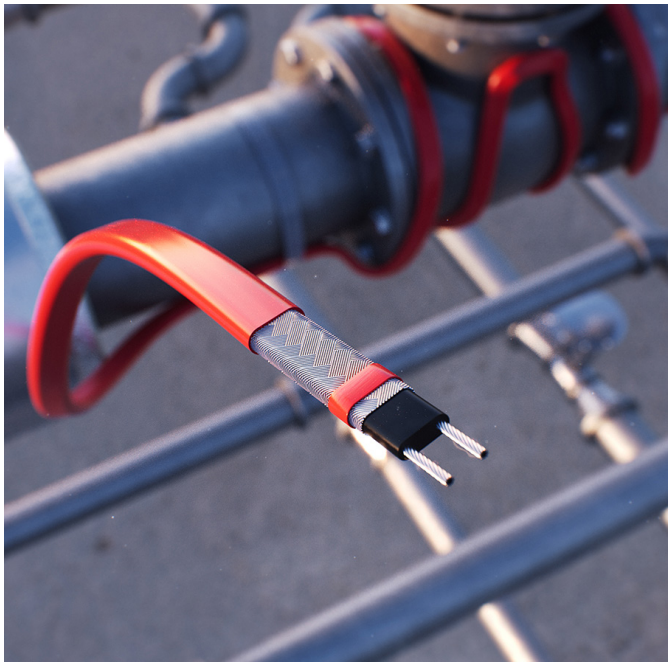
Prefabricated standing seam insulation panels installation

facility. Investing in the most efficient tank insulation and heat tracing controls can also help tank farm operators offer a more cost-effective storage solution to potential customers, especially considering that tank and pipe heating are often charged as additional cost on top of rental rates.

Providing a more effective and hardwearing alternative to traditional insulation, high-quality standing seam insulation panels are the best option for facility owners looking to maintain tanks at a consistent temperature, sustainably. In contrast to traditional systems, we also offer closed-cell insulation materials (such as polyisocyanurate, PIR) that do not degenerate or lose insulation capacity over time, meaning no extra heating power is needed to mitigate increased heat loss towards the end of the tanks' lifetime. In a direct evaluation of two newly installed systems, closed-cell materials represent superior performance when compared with mineral wool, thanks to their lower thermal conductivity rating (*greenspec*, 2024). The overall result is a storage facility that offers the environmental responsibility producers increasingly expect, with the economic benefits they need to maintain that all-important competitive edge.

Accurate control for adaptable tank storage

Regardless of size or location, precise temperature control of chemical fluids during transport to and from loading sites is a foundational consideration. At their most basic level, in-feed line heat tracing systems must be able to maintain the optimum temperature for product quality and safety. However, to allow customers to shift their storage strategies in line



Self-regulating heating cable

Customer control room

with commodity prices and market demand, site owners also need pipe heat tracing circuits that can be reconfigured quickly to accommodate any type of critical liquid.

The most advanced heat-tracing controllers deliver flexibility via a combination of tried-and-tested line sensing temperature monitoring and more recently introduced 'true power' control. This feature enables the heat tracing system to measure voltage and current in real-time and to adjust the power output to match the precise temperature requirements of any chemical

> **"The most advanced heat-tracing controllers deliver flexibility via a combination of tried-and-tested line sensing temperature monitoring and more recently introduced 'true power' control"**

product – both for storage and transportation. This high degree of accuracy represents an improvement in the performance of more traditional heat tracing controllers, minimising the risk of excessive power use while also allowing for greater cable standardisation across the entire installation.

This feature also offers facility managers the benefits of variable voltage capabilities. It allows them to better manage differences between the initial design and the system as built and ensure critical pipe infrastructures can be quickly and accurately configured to transport any chemical fluid.

Maximising reliability and ROI

To keep tanks operating profitably throughout their entire service life, facility owners need durable, low-maintenance insulation solutions that can withstand increasingly harsh and unpredictable weather conditions. When seeking to maximise the longevity of any tank installation, particularly in coastal regions, a crucial consideration is corrosion under insulation (CUI). CUI can potentially reduce the life of a tank down from 40 to as few as 10 years, all the while damaging profitability further through the deterioration of insulation performance and the need for frequent maintenance.

Standing seam insulation panels are helping to make CUI a challenge of the past with their dense structure, unique double-folded seam methodology, and seamless interlocking installation method, which removes the need for outer screws. These panels absorb far less water over their lifetime and are more resilient to even the worst weather conditions, delivering reliable and long-lasting insulation performance (*nvent/Raychem, 2024b*).

Case study 1: Self-regulating heating cable for process temperature maintenance and Trac-Loc panels for seamless tank insulation

A major client was expanding its biodiesel terminal in Winnipeg, Manitoba, in order to store B100, a pure biodiesel product. As this has a higher gel point than regular diesel, it required a more precise temperature. The customer's mission-critical objective was to find a complete heat management solution for the piping that

would maintain the pre-determined temperature for this temperature-critical application, as well as insulation of the tank that would store the B100 – all within its aggressive schedule. nVent engineers designed a system using Raychem XTV heating cable due to its design flexibility to maintain an accurate temperature. Raychem The Trac-Loc advanced interlock standing seam panel system was used to insulate the tank. Since Trac-Loc panels are prefabricated off-site, this insulation solution eliminated the need for scaffolding, resulting in a seamless and timely system installation.

Case study 2: Trac-Loc panels for seamless tank insulation for upgraded tank terminal reliability

A major client was upgrading its terminal tanks in Rotterdam (NL), Antwerp (BE), and Fawley (UK). The customer's mission-critical objective was to find an energy-efficient, cost-effective tank insulation solution that offered high rigidity, reduced moisture ingress, and minimised CUI. nVent engineers designed prefabricated Trac-Loc panels using PIR closed-cell insulation material and aluminum metallic jacketing, with a double-locking vertical seam construction to insulate the tanks. Trac-Loc prefabricated panels simplified installation because they minimised material handing and eliminated the need for scaffolding, resulting in minimal operational disruptions, fewer onsite man-hours, and less cost. Additionally, the prefabricated standing seam insulation panels and double-seam attachment technique offer a system with long-term reliability and performance, significantly reducing maintenance costs associated with CUI-related issues. Finally, the system resulted in substantial energy savings for the client, further supporting operational efficiency and reduced carbon footprint.

Keeping tanks safe and sound

These advanced tank insulation and heat tracing solutions must also improve site safety. With companies investing in more large-scale storage facilities for sensitive or hazardous chemicals, tank farm owners are searching for systems that can help the industry expand production without increasing risks to people, property, or the environment.

In addition to true power control, smart heat tracing controllers are equipped with intelligent features like self-test functions, bespoke alarms, and continuous system monitoring, which means faults are identified and resolved before they can threaten site safety. Meanwhile, the long-term durability and corrosion resistance offered by standing seam insulation minimises the risk of tank fissures or harmful chemical leaks, protecting the health of workers on site, as well as precious natural landscapes.

Summary

Despite current challenges, the future is looking bright for the chemical storage sector. Demand for specialised chemicals to fuel new technologies and renewable energy generation projects is already driving investment, and as decarbonisation efforts continue, further growth opportunities are on the horizon.

> **"Flexible, energy-efficient storage sites will play a critical role in helping the chemical sector navigate fluctuations in price and policy"**

The watchword for tank farm operators must be 'adaptability'. Flexible, energy-efficient storage sites will play a critical role in helping the chemical sector navigate fluctuations in price and policy. Smart, adaptable solutions like the Raychem heat-tracing systems offered by nVent Thermal Management can help to futureproof tank sites. Armed with these technologies, tank farm owners can capitalise on expanding demand and be confident that their facilities are primed to thrive, whatever the future may hold.

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Kees Oerlemans
Kees.Oerlemans@nVent.com

Koen Verleyen
Koen.Verleyen@nVent.com

Pele Myers
Pele.Myers@nVent.com

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