RBN Energy LLC

Daily Blog *(/daily-energy-post)*

On Top of the World - Next Wave Uses Innovative Approach to Produce High-Quality Alkylate

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It's been about a year and a half since Next Wave Energy Partners opened its Project Traveler facility, a milestone in the energy industry. Overall, Project Traveler has exceeded production expectations and proven the innovative approach of combining ethylene and isobutane to produce high-quality alkylate. In today's RBN blog, we'll look at what's been accomplished so far and dive into what's ahead for Next Wave.

We first mentioned Next Wave's ethylene-to-alkylate project (see photo below) back in 2020 in **Drive My Car** *(https://rbnenergy.com/drive-my-car-the-thinking-behind-a-planned-gulf-coast-ethylene-to-alkylate-project)* . (We also discussed it in **Keeps Getting Better, Part 1** *(https://rbnenergy.com/keeps-gettin-better-part-2-project-eyes-using-ethanol-to-make-bioethylene-renewable-alkylate-saf)* and **Part 2** *(https://rbnenergy.com/keeps-gettin-better-part-2-project-eyes-using-ethanol-to-make-bioethylene-renewable-alkylate-saf)* , and, most recently, in **Traveler** *(https://rbnenergy.com/traveler-supply-demand-trends-that-spurred-a-gulf-coast-ethylene-to-alkylate-project-hold-up)* .) It is a unique, standalone alkylation facility, with no crude oil processing involved. Instead, the feedstock is ethylene, which is converted to butylene in a dimerization unit and then further converted to alkylate in a conventional sulfuric acid (H_2SO_4) alkylation unit. (More on this below.)

Figure 1. Next Wave's Project Traveler in Pasadena, TX. Source: Next Wave

As a brief refresher, gasoline is a blend of many hydrocarbon components (including alkylate) that, in combination, meet certain specifications. It's up to refineries and gasoline blenders to come up with gasoline recipes that satisfy the requirements of specifications like Reid Vapor Pressure (RVP), octane and sulfur content. As you're reminded with each visit to the pump, there are at least three octane-based grades of gasoline; the standard ones in most of the country are 87 (regular), 91 (midgrade) and 93 (premium). The octane number — the closer to 100 the better — indicates how much a fuel can be compressed before it self-ignites, which causes "knocking" in your engine, while RVP measures how easily a fuel vaporizes — typically the lower the better for emissions reasons.

Blendstocks that are high in octane and low in RVP, benzene and sulfur content are the most desirable for refineries and gasoline blenders. Alkylate, typically produced at crude oil refineries with fluid catalytic cracking units (FCCs), is perhaps the major gasoline component with the best combination of these four qualities: octane of 90 to 96, RVP of 3 to 6 pounds per square inch at atmospheric pressure (psia), zero benzene content, and sulfur content of only 5 to 15 parts per million (ppm).

ANALYST INSIGHTS *(/ANALYST-INSIGHTS)*

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PADD 1 Propane Stocks Show Unseasonal Weekly Draw

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While overall gasoline demand in the U.S. has remained relatively flat over the past several

using higher compression and turbocharged engines, which require higher-octane fuels. Another factor incentivizing the production of high-octane components is the "lightening" of U.S. refiners' crude slates due to the Shale Boom. When higher-API shale oil barrels are refined, they produce more naphtha, which has a low octane number and therefore needs to be "blended up" with high-octane components like alkylate in the gasoline pool. An important fact to note is that existing refineries can't do much to ramp up their alkylate production (typically representing about 15% of the total gasoline pool) because they already run full in almost all circumstances.

This brings us back to Next Wave and Project Traveler. The company decided to develop a non-refinery project using the dimerization and alkylation processes to produce a top-notch alkylate from price-advantaged NGL-based feedstocks. Figure 2 below shows how the processes work. Project Traveler's dimerization unit (blue boxes to left) reacts ethylene to form butylene, and its alkylation unit (blue boxes to right) reacts isobutane with that butylene to form alkylate, with no material byproducts. Next Wave's trade name for its resulting higher-quality alkylate is ***Optimate***.

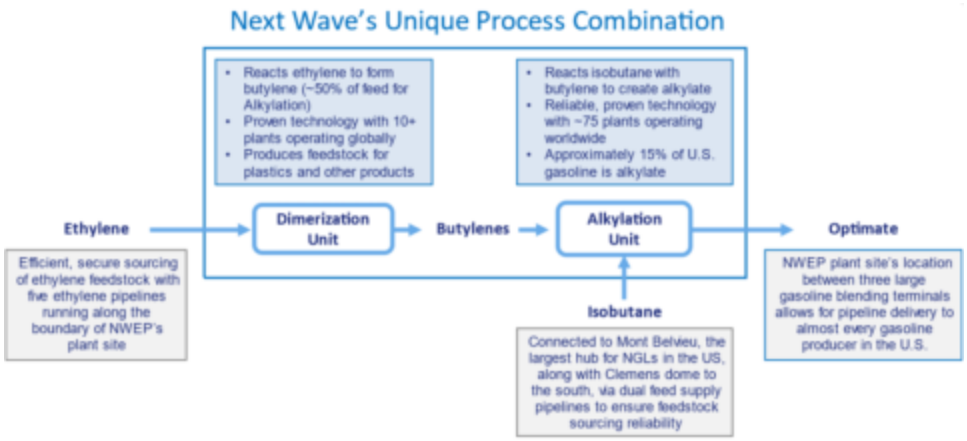

Figure 2. Ethylene-to-Alkylate Production Process. Source: Next Wave

Next Wave can produce Optimate with an octane rating as high as 96.5 — 4 points higher than the average 92.5-octane alkylate produced at refineries — with an RVP of only 3 psia, compared with 5.5 psia for typical refinery-produced alkylate, and sulfur content of less than 5 ppm, versus up to 15 ppm for refinery alkylate. In addition, we understand that Optimate has a carbon intensity (CI) that is around 5% lower than traditional gasoline due to using only ethylene/NGLs as feedstock (rather than crude oil) and the utilization of "waste steam" from a cogeneration facility located next door.

Next Wave's operating strategy aims to maximize long-term commitments for ethylene supply and alkylate offtake, ensuring the plant's capacity is highly utilized. We understand the plant's output has exceeded its nameplate capacity by a considerable degree (more on that below), which enables Next Wave to receive more ethylene from steam-cracker owners and produce more alkylate for its customers. We should note that while Next Wave often uses ethylene as its primary feedstock, it has the option of using propylene, isobutylene, petrochemical raffinate and refinery-produced olefins.

with commodity prices — in this case, ethylene, isobutane and alkylate. Prior to making its final investment decision (FID), Next Wave entered into a number of agreements under which steam-cracker owners committed a portion of their ethylene output (we are estimating a total of about 1 billion pounds per year) and gasoline blenders committed to buying specified volumes of alkylate, thereby locking in their margin. Through these deals, the commodity price risk is allocated to the ethylene suppliers and alkylate consumers looking to hedge their own long and short positions, respectively. The alkylate is shipped on Next Wave-owned pipelines to the Kinder Morgan and Intercontinental Terminals Co. (ITC) terminals in Pasadena, TX, for distribution, capitalizing on the importance of hydrogen-rich gasoline (see **Can I Kick It?** *(https://rbnenergy.com/can-i-kick-it-hydrogen-rich-gasoline-might-provide-a-boost-for-refiners-but-challenges-remain)*) for direct blending.

One of the keys to this project's long-term success is the gasoline market, as we addressed earlier. **RBN's Refined Fuels Analytics (RFA) practice** *(https://rbnenergy.com/refined-fuels-analytics)* forecasts that global gasoline demand will continue to grow to 2035 and decline only gradually by the end of its forecast period in 2040. RFA also sees alkylate remaining a high-value gasoline blendstock due to its high octane number and positive emissions-related properties (low RVP, low sulfur content, zero aromatics). We expect ethylene to continue to be widely available along the Gulf Coast — and priced at an advantaged, export-parity basis — as further steam-cracker capacity comes online and demand for ethylene stagnates domestically but continues to grow overseas.

With Project Traveler performing well, we understand that Next Wave is progressing on several fronts:

- **Logistics** — Pipeline construction is underway to connect the Project Traveler site directly to Enterprise Product Partners' Mont Belvieu, TX, open-access ethylene storage system. With completion expected in Q4 2025, Next Wave will have additional feedstock storage and be able to receive ethylene directly from more than 30 suppliers.

- **Expansion** — With the project's strong success, the company is already having discussions with customers and suppliers to evaluate an approximate 25% capacity expansion. Although no formal announcement has been made, we are aware that engineering is in progress. Next Wave noted in its press release announcing commercial operations that the facility was designed from the outset for such an expansion.

- **Renewables** — Next Wave is looking to leverage its existing facility by the addition of an ethanol-to-ethylene unit known as Project Lightning. The addition of this unit to the front end of the existing Project Traveler facility would allow Next Wave to utilize ethanol as feedstock to produce carbon-negative ethylene, renewable alkylate that qualifies for Renewable Identification Numbers (RINs), and sustainable aviation fuel (SAF), all from the same system, allowing for significant production flexibility. We saw an announcement from Lummus Technology late last year (October 2024) that Next Wave and Lummus had worked together to produce the world's first renewable alkylate, with the successful run made at the Project Traveler facility. Next Wave also recently received approval from the U.S. Environmental Protection Agency (EPA) for gasoline blends with up to 79% renewable alkylate content. At a time when many other "green" projects are being shelved, this one does seem to be slowly progressing.
- **Diversification** — Next Wave holds an approved air permit for the construction of a metathesis unit to produce up to 1 billion pounds per year of polymer-grade propylene (PGP) at the Project Traveler site. This would appear to be a natural fit, as metathesis is also a two-step process, starting with dimerization of ethylene to butylenes (sound familiar?) followed by the reaction of those butylenes with additional ethylene to yield PGP. (Propylene is primarily used as a raw material in the production of polypropylene, a plastic used in packaging, auto parts and other applications.) Given that Next Wave already has its large dimerization unit in operation, installing the metathesis reactor to diversify into propylene would seem to be in its fairway. The site also has multiple PGP pipelines for product takeaway literally on the property fenceline. Metathesis technology has become popular for its ability to boost propylene production with lower costs and higher reliability compared to propane dehydrogenation (PDH).

As we reflect on Project Traveler's first 18 months, it's evident that Next Wave has crafted a novel approach in the energy sector and has achieved several important "firsts." The project has demonstrated the capability to produce high-value, octane-boosting alkylate from widely available and cost-effective feedstocks, contributing to advancements in gasoline blending components and cleaner-burning fuels. We're excited to watch Next Wave's next venture.

RBN's Refined Fuels Analytics (RFA) practice has a deep understanding of Project Traveler and other projects. For more information on RFA and its areas of expertise, ***click here*** *(https://rbnenergy.com/refined-fuels-analytics?utm_source=Text-Ad&utm_medium=Web&utm_campaign=RFA) . The next edition of RFA's biannual* ***Future of Fuels*** *(https://rbnenergy.com/products/future-of-fuels?utm_source=TextAd&utm_medium=Web&utm_campaign=Future-of-Fuels) report will be published in July.*

"On Top of the World" was written by Ben McKee, Dan Platzman, Dan Reynolds, Wayne Sermon, and Alexander Grant. It appears as the fifth song on Imagine Dragons' debut studio album, *Night Visions.* The song is a celebratory paean to the band's success after years of struggle. It has been featured in motion pictures, television shows, ads, and video games. Released as a single in March 2015, it went to number ten on the Billboard Hot Rock & Alternative Songs and number 79 on the Billboard Hot 100 Singles charts. It has been certified 5x Platinum by the Recording Industry Association of America. Personnel on the record were: Dan Reynolds (lead vocals), Wayne Sermon (guitars, backing vocals), Ben McKee (bass, backing vocals), and Dan Platzman (drums, drum machine, backing vocals).

Night Visions was recorded between 2009 and July 2012 at Studio at The Palms in Paradise, Nevada, Battle Born in Winchester, Nevada, and Westlake in Los Angeles. Produced by Alex da Kid, Brandon Darner, and Imagine Dragons, it was released in September 2012 and went to number two on the Billboard 200 Albums chart. It has been certified 8x Platinum by the RIAA. Five singles were released from the LP.

Imagine Dragons is an American pop-rock band formed in Las Vegas in 2008 by Dan Reynolds, Wayne Sermon, and Ben McKee. They have released six studio albums, four live albums, a compilation album, 10 EPs, and 27 singles. They have won three American Music Awards, eight BMI Pop Music Awards, a Grammy Award, an MTV Video Music Award, and a World Music Award. Ten touring musicians have passed through the group since its inception. They recently released a concert film, *Imagine Dragons: Live From the Hollywood Bowl,* that appeared at selected theaters. Their *Loom World Tour* begins in May 2025.