



**INFRA**  
GTL TECHNOLOGY

# **GAS-to-OIL:** **NEW GENERATION** *of* **GTL TECHNOLOGY**

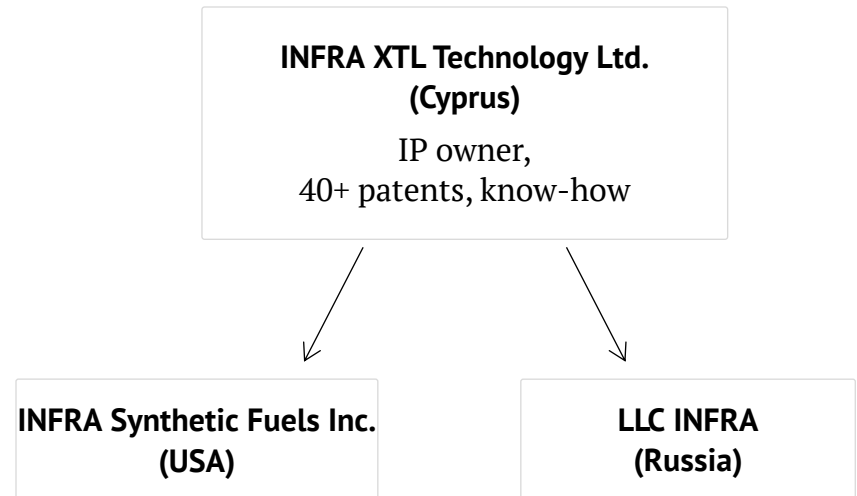
**Sell Your Gas at  
\$75 per Barrel**



**INFRA Technology is a technology licensor and catalyst supplier for the commercially ready Fischer-Tropsch process for the production of value-added light **synthetic crude oil** and clean liquid synthetic transportation fuels from **Natural, Associated and Renewable Natural Gas and Biomass feedstock**.**



*INFRA's catalyst factory*



*Corporate Structure*

# Gas-to-Synthetic Crude Oil Innovative Technology

INFRA's Fischer-Tropsch product – **light synthetic crude oil** – is fully compatible with the existing oil industry infrastructure and technological processes.



Mixes well with mineral crude oil.



Can be upgraded to ultra-high quality drop-in diesel, jet fuel or gasoline.



Clean product has no aromatics, no sulphur and no asphaltenes.

75%

Emissions reduction of up to 75% over conventional motor fuels.

# Value Proposition

INFRA's technology offers significantly (by up to 50%) lower capital costs and operating expenses. INFRA's technology makes production of synthetic oil economically feasible, ensuring that GTL process is **profitable as a rule** and **cost competitive with oil refining**. It is at least 50% less expensive than comparable technologies.



High quality single liquid product – *synthetic oil* - that does not require hydrocracking and upgrading; and high process efficiency are key to the technology's economic feasibility.



# Green Technology

**INFRA aims to become the internationally leading provider of economically viable GTL technology for the production of Clean burning synthetic fuels, in a Low Carbon plant design with an industry leading reduced carbon footprint.**

**The product qualifies under **Renewable Fuel Standard Program (RINs)** (USA) and **Renewable Fuel Transport Obligations (UK)** legislation.**

Applications for INFRA's high carbon efficiency products include:

- Renewable sulfur-free biodiesel and gasoline for environmentally friendly urban and other road transport.

Synthetic fuel is a premium product that improves engine performance, extends engine life and significantly reduces emissions;

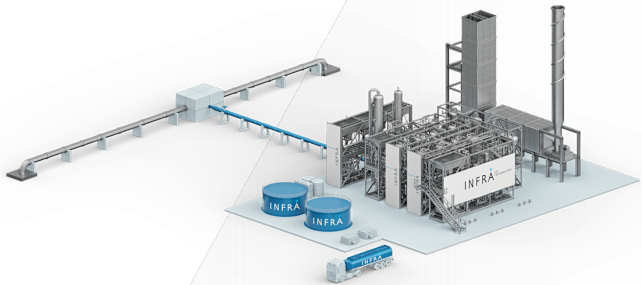
- Environmentally friendly aviation fuel (SAF) from renewable raw materials;
- Environmentally friendly marine fuel in accordance with IMO 2020;
- Specialty chemicals.



# Business Model

## Our Objective

The company aims to become the internationally leading provider of economically viable GTL technologies for the production of Clean burning synthetic fuels, in a Low Carbon plant design with an industry leading reduced carbon footprint.



*Transportable modular GTL plant for processing natural gas into synthetic crude oil*

## Sources of Revenue

- Sale of technology licenses for construction and operation of industrial plants based on INFRA's GTL technology;
- Regular supplies of the proprietary catalyst, as well as
- Engineering studies (feasibility studies, conceptual studies, pre-FEED, FEED),
- Project-related engineering services (owner's engineer, operator training, catalyst replacement),
- Commissioning support,
- Sale of small-scale modular transportable GTL units (M100) for flared gas and associated gas utilization, Biomass to Liquids production, and RNG conversion.

# Completed Projects

<i>Project</i>	<i>GTL Size (BPD)</i>	<i>Client</i>	<i>Location</i>	<i>Phase</i>	<i>Year</i>
Pilot GTL Plant	0,25	VNIIGAZ Gazprom	Russia	Sold	2010
Pilot GTL Plant	0,25	INFRA	Russia	In operation	2014
Pilot GTL Plant	200	Gazpromneft	Russia	Pre-feasibility study	2015
Floating GTL Plant	1,000	MISC	Malaysia	Pre-feasibility study	2015
GTL plant for producing diesel and kerosene	1,200	INDIGA	Russia	Feasibility study	2016
Demonstration GTL plant	100	INFRA	USA	Sold	2016–2018
GTL plant for producing diesel, gasoline and LPG	500	Nenetsk Oil Company	Russia	Feasibility study	2018

# INFRA Achievement Summary

**INFRA developed a unique Fischer-Tropsch (FT) catalyst for producing synthetic crude oil from synthesis gas**

- Less than 2% of waxes (long-chain hydrocarbons) in the FT product;
- High productivity (smaller FT reactor size – lower capital cost);
- Up to 1.5 years catalyst life, requires little rejuvenation during this period;
- All key inventions patented, patent protection until 2037.

**INFRA built a full-cycle pilot facility**

- Catalysts are tested under same industrial conditions – temperatures and space velocities - as in commercial reactors;
- Pilot facility differs in terms of the number of reactor tubes only.

**INFRA built its own catalyst factory for scaling catalyst manufacturing procedures to industrial production**

- Industrial catalyst manufacturing procedures fully developed;
- Five (5) tons of FT catalyst produced for the demonstration plant (3 full loads);
- Catalyst factory has capacity of 20 tons of catalyst per year and can comfortably supply a 1,500 BPD GTL plant.



# M100 Demonstration GTL Plant

**INFRA designed and built a proof-of-concept GTL plant in Houston (M100) in order to test and demonstrate INFRA's unique proprietary GTL technology.**

Modular transportable GTL plant for processing natural and associated gas into synthetic oil, producing 100 barrels of synthetic oil from 1 million cubic feet of gas per day.

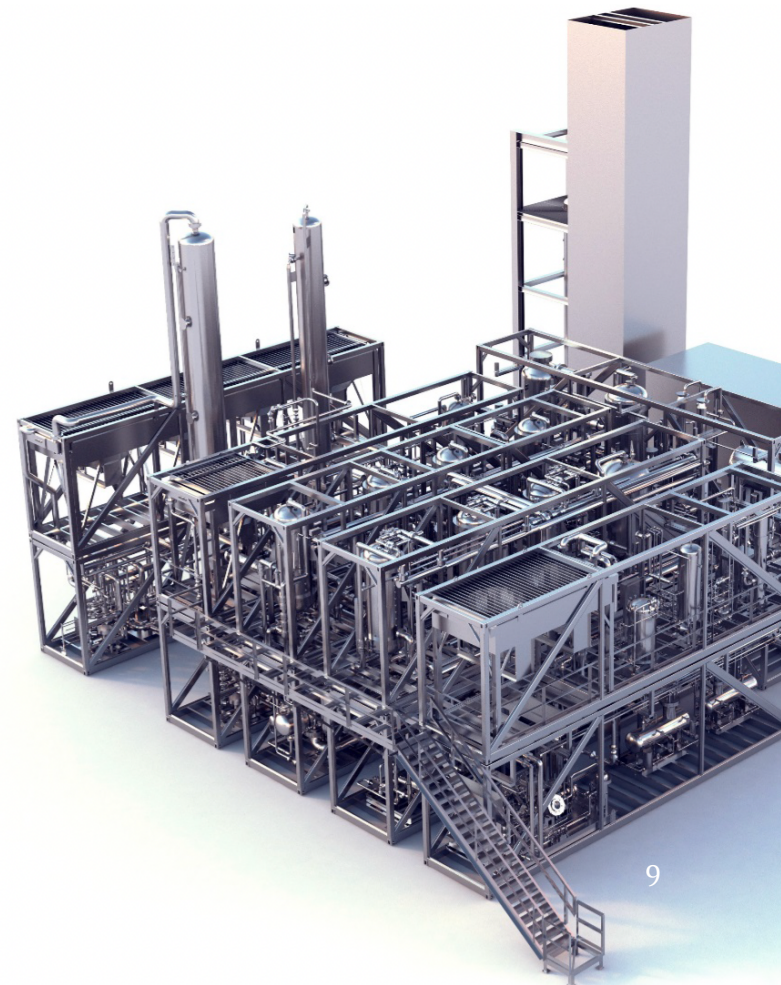
Produces synthetic oil – a mixture of diesel and gasoline fractions in 65/35% proportion. Up to 45% kerosene fraction. Product contracted to Shell Deer Park refinery.

In 2019 M100 was acquired by Greenway Technologies, Inc. (OTC:GWTI).

INFRA issued a technology license for operating M100 to GWTI and will supply its proprietary S2 Fischer-Tropsch catalyst.

**4000** square feet  
plot plan

**14** road and ship  
transportable modules





INFRA – NEW GENERATION OF GTL TECHNOLOGY

# M100 GTL Plant Wharton (Texas, USA)

INFRA designed and built a modular transportable GTL plant for processing natural and associated gas into synthetic crude oil.



[Watch video](#)

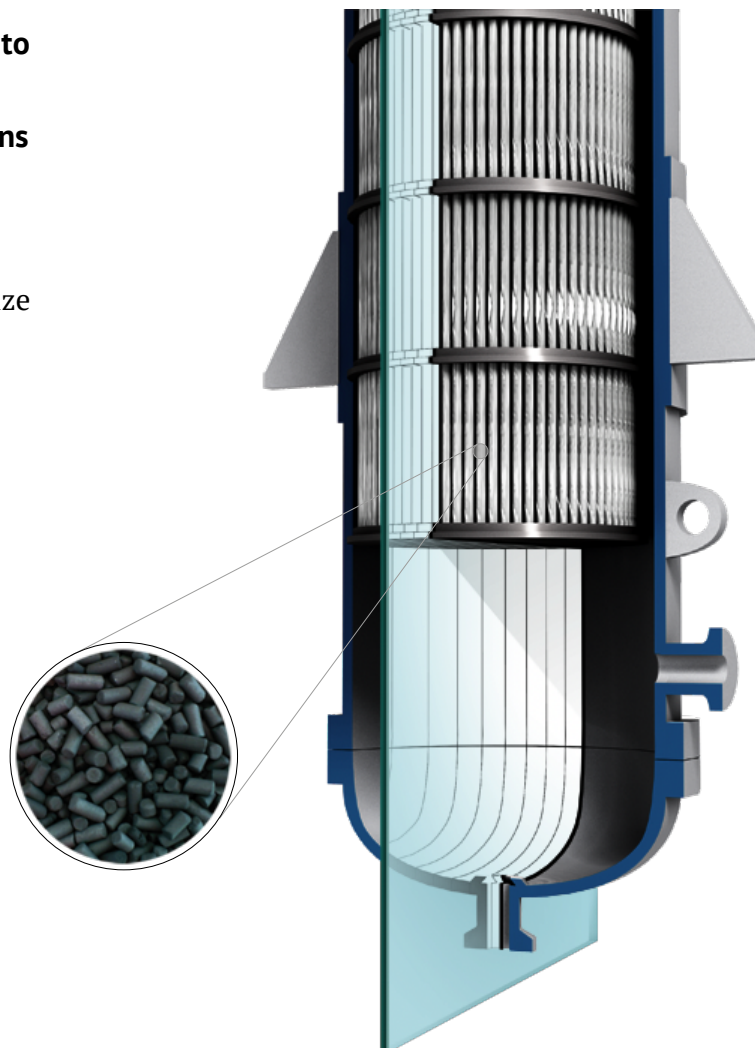


# Unique Patented Catalyst

**INFRA continues to work on improving existing catalysts to increase conversion, selectivity and productivity, and also develops selective catalysts for certain petroleum fractions (diesel, kerosene)**

**The current catalyst for synthetic oil (S2) represents the 3rd generation of catalysts** specifically designed for industrial-size reactor tubes

**INFRA files international patent applications for all catalyst improvements**, and upon receiving the patent continues to maintain it in the key jurisdictions



# Technology Protected by Patents Until 2037

<i>Patent No.</i>	<i>Countries</i>	<i>Title</i>	<i>Validity</i>
US 9878314	RU, US	Catalyst for direct production of isoparaffin-rich synthetic oil and method for preparing catalyst.	2014–2032
PCT/RU2018/000344	RU	Catalyst for Fischer-Tropsch synthesis and preparation method hereof.	2019–2037
US 8,735,317	RU, US, AU, CA, CN, EU, JP, SA	Catalyst for synthesis of hydrocarbons from CO and H <sub>2</sub> and preparation method thereof.	2010–2029
US 9,446,396 B2	RU, US, AU, CA, CN, EU, JP, SA	Support for catalyst of exothermic processes and catalyst prepared thereon.	2011–2029
US 8,524,787	RU, US, AU, CA, CN, EU, JP, SA	Process for producing synthetic liquid hydrocarbons and reactor for Fischer-Tropsch synthesis.	2012–2030
US 9,290,700 B2	RU, US	Method for Preparing Synthetic Liquid Hydrocarbons From CO and H <sub>2</sub> .	2016–2034
Appl. 15/540,016 Pat. Pending	RU, US	Method for Preparing liquid hydrocarbons for natural gas (alias "hybrid scheme").	2018–2034
RUS 2422202	RU	Catalyst for Fischer-Tropsch synthesis and process for producing hydrocarbons based on this catalyst.	2011–2029
US 8,865,613 B2	RU, US, AU, CN, JP, SA	Catalyst for synthesis of hydrocarbons from CO and H <sub>2</sub> and preparation method thereof.	2011–2029
PCT/RU2015/000747	RU	Cross-Baffle for Spacing Tubes in Multi-tubular Apparatus.	2016–2034



# Key Technology Differentiation

## Clean, liquid product

straight out of the Fischer-Tropsch reactor. No heavy waxes. No by-products.

## No need for hydrocracking and product upgrading

— simplified process flowsheet significantly reduces capital costs, operating expenses and plant carbon footprint.

Synthetic crude is **fully compatible with the existing oil infrastructure.**

An option to upgrade the FT product to **clean burning motor or jet fuels** that reduce emissions by 75% over natural crude by adding inexpensive process.

**Versatility** — technology allows for utilization of feed gas with varying density, composition and volume, from dry methane up to heavy gases. Lowest cost add on to existing Biomass plants.

**Compact design** enables adaptation to changing or fluctuating production volume.

**Self-sustained process** — technology is self-sufficient for water, steam and electricity for the plant's needs.

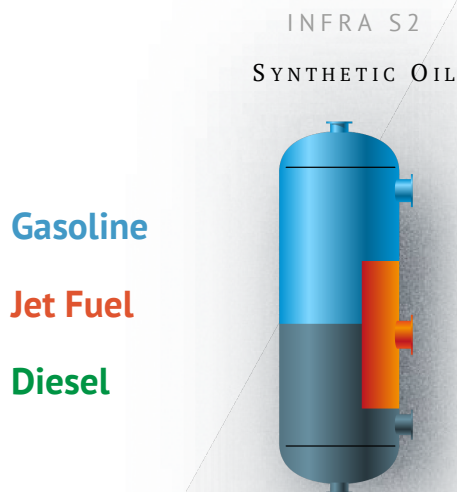
**No flaring,** emergency flaring only.

**Clean Fischer-Tropsch water** re-used in the process in the closed loop.

**High tolerance to the presence of CO<sub>2</sub>** in the feedstock. Moderate CO<sub>2</sub> concentrations (up to 20 %vol.) lead to significant advantages in both capital and operational expenses.

**Improved catalyst stability** — no less than 1 year of useful life without extensive rejuvenation.

# Synthetic Crude Oil – Single Liquid Product, No Waxes



<i>Parameter of INFRA Synthetic Crude Oil</i>	<i>Method</i>	<i>Value</i>	<i>Unit</i>
API at 60°F	ASTM D4052	59.6	API
Vapor Pressure, VPCR at V/L=4 and 100°F	ASTM D6377	1.99	psi
Kinematic Viscosity, at 20°C (68°F)	ASTM D445	1.352	cSt
Pour Point	ASTM D97	-15	°C
Sulphur Content		0	mg/kg
FT Naphtha/gasoline fraction (IBP-300°F)	ASTM D2892	35	wt%
FT Jet/Kerosene fraction (300-575°F)	ASTM D7169	55	wt%
FT Diesel fraction (300°F-FBP)	ASTM D2892	65	wt%
Heavy Paraffin Content	UOP-46 modified	2.8	wt%

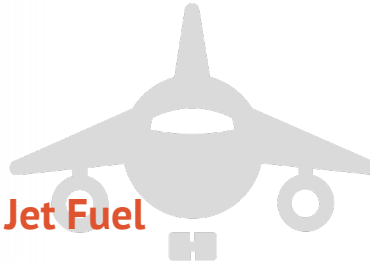
*Syncrude produced with S2 INFRA FT catalyst in 6m (20ft) reactor tube  
Testing by SGS (July 2018); Saybolt (October 2018)*

# Clean Synthetic Motor Fuels



## Diesel

- High cetane index ( $\cong 70$ );
- Zero sulphur content;
- Reduced local emissions (particles and NO<sub>x</sub>);
- Blendable up to 100%;
- Improved engine durability;
- Less noise and smell;
- No by-products;
- Compatible with the existing standards (ASTM D975 D-1 and D-2).



## Jet Fuel

- Synthetic paraffinic kerosene (FT-SPK);
- Higher energy density by weight;
- Blend component for jet fuel (up to 50%);
- Lower level of impurities – clean burning;
- SAF study in progress (due Nov 2021)



## Gasoline

- Drop-in gasoline or blend stock;
- Excellent steam cracker feed (higher yield for high value chemicals);
- Canadian crude diluent;
- Ethanol denaturant;
- Different solvents.

# INFRA Assets

An outstanding multidisciplinary R&D team, including 9 PhD's, consisting of specialists in catalysis, surface chemistry, chemistry and physics of membranes, material sciences, chemical technology and engineering, and mathematical modeling of chemical processes.

INFRA has commissioned its own production of the proprietary Fischer-Tropsch catalysts. Production capacity is up to 20 tons per year.

In 2014 INFRA commissioned and continually operates the new, larger scale full cycle pilot plant. It is differentiated by a high degree of automation and extensive data gathering system. The unit tests different single-tube and multi-tube **reactors of up to 6000 mm in height**, intended for use in INFRA's industrial-scale GTL plants.

INFRA's technology has been verified by both Russian and international leading labs and Global oil & gas operators.



[Watch video](#)



[Independent Expertise](#)

# Key Managers



**VALERY BALIKOEV**  
Founder and CEO

- Valery Balikoev founded and developed the company around the nucleus of the research group headed by prof. V.Z.Mordkovich. Mr. Balikoev is actively involved in the company's activities, in particular, in the development and implementation of the strategy of commercialization of synthetic fuels technology, and in general management of the company.
- Over the past 20 years Mr. Balikoev founded and managed a number of commercial ventures, including one of the largest underground utilities construction companies in Moscow.
- Mr. Balikoev graduated from the Moscow Institute of Electronic Engineering (Russia).



**Dr. VLADIMIR MORDKOVICH**  
CTO

- Dr. Mordkovich is the author of INFRA's core GTL technology and one of the co-founders of the company since 2009.
- Dr. Mordkovich is directly involved with GTL-related patent origination, operations and testing program of INFRA's pilot unit, as well as product quality control at the company's own catalyst factory.
- Dr. Mordkovich manages INFRA's multidisciplinary R&D division and ensures smooth interaction and technology transfer to the engineering and operations departments of the company.
- Dr. Mordkovich holds 45 inventions in the field and has authored over 120 publications in peer-reviewed journals. Before founding INFRA, he spent 11 years in Japan working for R&D companies. He leads the New Chemical Technologies and Nanomaterials Research Department at the Technological Institute for Superhard and New Carbon Materials (TISNCM) in Moscow, Russia as well as having been selected to the Academic Council.



**DMITRY POPOV**  
Managing Director

- Mr. Popov holds overall responsibility for financial management and control as well as the company's commercial development. He maintains key international accounts, including major oil & gas companies. He was instrumental in closing the second round of the company's financing in 2013.
- Mr. Popov joined INFRA in 2011, having spent his previous career in corporate finance with international financial institutions. He has almost 20 years of investment banking experience, specializing in cross-border M&A, IPOs and private placements.
- Mr. Popov holds an MBA from the Madrid Business School at the University of Houston and graduated from the Moscow State University (Political Economy).



**KEEP  
CALM  
AND  
MAKE  
OIL**