PRODUCT DESCRIPTION

S2J™ Diesel:

- Is a clean hydrocarbon product that is *Ultra-low* in sulfur, **despite** being derived from coal.
- Reduced levels of plating-out metals that destroy engines – compared to oil-refined diesel.
- Cetane numbers will range from 55-60, perhaps even higher from the *Ether*-oxygen content.
- Expected to grade similarly or superior to fuels graded according to *ASTM specification* **D975-17a**. The grades addressed are as follows:

  1.1.1 Grade No. 1-D S15—A special-purpose, light middle distillate fuel used in diesel engine applications requiring a fuel with 15 ppm sulfur (max.) and higher volatility than that provided by Grade No. 2-D S15 fuel.

  1.1.4 Grade No. 2-D S15—A general purpose, middle distillate fuel used in diesel engine applications requiring a fuel with 15 ppm sulfur (max.) -- especially suitable in applications with conditions of varying speed and load.

  1.1.7 Grade No. 4-D—A heavy distillate fuel, or a blend of distillate and residual oil, for use in low- and medium-speed diesel engines in applications involving predominantly constant speed and load.

TABLE 1: COMPARISON OF S2J DIESEL FUEL TO KNOWN SPECIFICATION PARAMETERS

Compares key established parameters between S2J Diesel Fuel and the requirements of various specification authorities. Specification testing thru ASTM D975 reports remaining parameters.

Fuel Specification Parameter	S2J Diesel	Grade No.2 Diesel ASTM D975	ASTM Test Methods	Euro VI	Bharat Stage (BS) Cat. IV
Sulfur content, (Max, ppm)	5 - 10	15	D5453	10	10
Aromatics (Max, Vol %)	< 30	*NR	D1319	29	35
Naphthalene (Max, Vol %)	< 3.0	*NR	D1319	8.0	11.0
Corrosion Copper Strip	No.1‡	No.3	D130	No.1	No.1
Density, (Max kg/m^3, 15 ^{o}C)	860	850	D7042	845	820-860
Flash Point, (Min, ^{o}C)	38	52	D93	55	35
Distillation Temp., (Max, ^{o}C)	320-350	338	D86	360	360
Viscosity @ 40 ^{o}C (cp [mm^2/s])	2-6	4	D445	2-5	2-5
Pour Point	-15˚ C.			01˚ C.	01˚ C.

*NR or "No Requirements" means that fuel Grades No. 1-D S15, No. 1-D S500, No. 2-D S15 & No. 2-D S500. Grades No. 1-D S5000, No. 2-D S5000 & No. 4-D do not have an aromatics content requirement under ASTM D975.

‡**No. 1** refers to the most stringent classification of corrosion to copper-containing materials. Fuel within this range of classification will have the least corrosion to fuel and engine systems made with copper. Further details provided in ASTM D130 Copper Strip Corrosion Test.

- The S2J™ hydrocracking reaction is self-sustaining at less than 300˚ C. It requires no heat / energy input, whereas forming the Syngas for Fischer-Tropsch incurs a high cost-penalty endotherm, at super refractory hard-to-manage temperatures, often exceeding 1,300˚ C.
- The H2H™ makes hydrogen & highly branched naphtha [HBN] from natural gas at < 300˚ C.
- The H2H™ requires ~2.1 MWh to convert 1 mt of NG to 110 kg of H_2 [plus 880 kg of HBN], whereas one would have to electrolyze 990 liters of water at a power cost of 5.5 MWh to yield 110 kg of H_2. Also, electrolysis of water produces ***no*** HBN.
- Our H2H™ and S2J™ processes require less than 20 atmospheres vs. Fischer-Tropsch's (F-T) 80 atmospheres for Syngas production.
- The H2H™ source of H2 requires energy input of 2.1 MWh per mt of Natural Gas processed, yielding ~7 mt of diesel fuel.
- For F-T to produce 7 tons of final product, it requires 20 to 25 MWh of energy. Using O2 separations from air easily adds another 5 to 15 MWh of additional energy overhead to this.
- F-T generates paraffin wax that requires additional processing steps — compared to our diesel fuel — penalizing F-T with double to triple the operating costs of H2H™/S2J™ diesel production.
- FloChem America devised poison-proof fluid catalysts with unlimited life-times, unlike F-T's solid catalysts which are consumed in operation and leave a significant, recurring operating expense.
- S2J™ diesel is virtually sulfur-free (5-10ppm), metals-free, with ~40% less NOx pollutants than convention diesel.

The H2H™ & S2J™ technologies are entirely new processes that **are not** & **do not resemble** natural gas liquefaction, Fischer-Tropsch, Sasol, or Compressed Natural Gas processes. These new processes produce liquid hydrocarbons while *phasing out* smog pollution, PM10, PM2.5, [**NEITHER** coarse --up to 10 micrometers -- **NOR** fine dust particles -- 2.5 micrometers or smaller] sulfur, nitrogen, harmful metals, carbon dioxide, carbon monoxide, & hydrogen sulphide. FloChem America scientists went to extreme lengths to remove pollution from these MSCP-derived liquid fuel products. There is no point in this effort, if the environment is not protected from feedstock transportion & production **in every way**:

> *In fact, a condition of the FlowChem license with WWTT requires that all coal shipments be sprayed with a topping agent on the coal to prevent coal dust pollution. The topping agent is sprayed directly on the coal in a continuous stream. Excess solution is trapped in a basin so it doesn't spill on the train itself or in between the rail cars. Each car is doused with between 12.5 & 20 gallons of the solution, which forms a sticky surface to keep dust from flying off while trains are moving. Midwest Industries' "Coal CarTopper System®" provides a good solution example that applies "Soil-Sement Engineered Formula®", a proven dust suppressant that keeps coal from escaping into the air.*
> *[http://midwestind.com/coal-car-topping-system/] .*

The unloading of coal & moving it into the S2J™ factory modules at the beneficiation facility is a hazard that must be carefully managed – historically, this is the most dangerous hazard for workmen in coal-fed enterprises. A key technique is submerging the conveyor below ground level so that even for the short distance it is moved from the source to the factory module hoppers, it requires no leverage for moving it.

Each H2H™, S2J™, Cellulose-to-C5/C6/Lignin, & Dextrose-to-XX, Xylose-to-YY, & Lignin-to-ZZ factory module will be manufactured, fully tested, & certified in accordance with all applicable U.S. OSHA [Occupational Safety & Health Administration, U.S. Dept. of Labor] regulations, including OSHA-2236 Materials Handling & Storage, FMCSA [Federal Motor Carrier Safety Administration, U.S. Dept. of Transportation], PHMSA [Pipeline & Hazardous Materials Safety Administration, U.S. Dept. of Transportation], & EPA [U.S. Environmental Protection Agency] regulatory rules & procedures. The

operations, troubleshooting, maintenance, repair & safety will be **exactly the same** for the beneficiation center, power plant, gas field, & the farm in the Host Country as they would be if each of these Program facilities was located in rural Nebraska of the U.S.

The yields stipulated for these MSCP factory modules will be equaled or exceeded in Florida laboratories as each unit process's input, pressure, temperature, and duration variables are fine-tuned for optimal outcome. The manufacture & purification of molten salt catalystic solvents for every load will be tested & verified by our scientists before they are accepted & shipped to Mozambique / India for charging. No factory module is accepted until the yield / purity / safety / operating conditions meet required specifications. Only then will our engineers oversee the installation & commissioning of each new factory module in Mozambique / India.

Each factory module will be monitored on a 24 x 7 basis for safety, accurate outputs, & yield performances. We will provide all relevant Local authorities & our investors with an extensive reference resource of all relevant **Safety Data Sheets** (SDSs) (formerly known as **Material Safety Data Sheets** or MSDSs) to communicate the hazards of hazardous chemical products which the Occupational Safety & Health Administration's 'Hazard Communication Standard' (HCS) requires chemical manufacturers, distributors, or importers to provide. The H2H™ process utilizes electricity to enable the molten metal salt catalysts to generate hydrogen gas & naphtha from the natural gas feed stock. The S2J™ processes are mildly exothermic – the energy required to generate liquid fuels is provided by combining hydrogen gas & coal within the factory module. Operations of H2H™ & S2J™ factory modules can be switched off simply by stopping the flow of feedstocks to the modules.

Verifying & Commercializing Molten Salt Catalysis Processing Solutions

The H2H™ & S2J™ Technologies: Kim L. Johnson worked with assistance from John Palumbo of FloChem America on the chemical design innovations of these MSCP processes and solvents. Both chemists have invested the more than a decade in developing molten salt solutions in both nuclear & non-nuclear sectors. Their beneficiation technology work is verified through their relationship with *Dr. Karl O. Christe, research professor of chemistry,* at USC's **LOKER HYDROCARBON RESEARCH INSTITUTE**. Established in 1977, the Institute has been rendered financially independent through a series of gifts from the Loker, Moulton, & Stauffer families. The Institute is "*at the forefront of the effort to find solutions to develop alternative hydrocarbon sources through new chemistry directed towards exploiting efficient ways of utilizing & recycling our present resources*." LHRI, developer of the lithium sulfur battery, made headlines 3 years ago when it found a way to produce hydrogen by recycling CO_2 through dehydrogenation of formic acid. LHRI researchers have also directly converted carbon dioxide taken from the air into methanol at relatively low temperatures.
See: *http://loker.usc.edu/intro.html* FTTA will enter into a collaboration agreement with LHRI to fine-tune its H2H / Coal Cleaning / S2J MSCP processes in their commercialization, along with the recruitment and training of chemical engineering candidates for our Florida lab facilities and field MSCP operations teams.

Optimal Economics & Regulatory Environment*:* The optimal environment from a Hazardous Materials Regulatory standpoint is *Florida*. Florida's HAZMAT protocols are comprehensive, intelligent, and well-established.
See: *http://www.dep.state.fl.us/waste/categories/hazardous/pages/laws.htm*

Florida's tax structure & economic environment are both pro-business. **See**:
https://www.enterpriseflorida.com/why-florida/business-climate/pro-business-leadership/

Local Technical Capacities: *University of Florida* offers a rich combination of computer engineering and chemical engineering resources that will provide technical support and recruits for our MSCP commercialization and deployment. **See**: http://www.cpe.eng.ufl.edu and https://www.che.ufl.edu/research-overview/. FTTA will enter into a collaboration agreement with UFL to

establish a chemical system modeling platform on our own servers to generate the functional specifications to feed the engineering design of the MSCP factory modules, as well as to recruit and train chemical engineer candidates for our Florida lab facilities and field MSCP operations teams.

Lab facilities in Florida: We will select seven laboratories with which we will collaborate in the set-up and fine-tuning of each of the unit processes involved in the H2H, Coal Cleaning, and S2J factory modules. Each lab will be equipped and cooperatively manned by our chemical engineers. A multiple of unit processes will be set up, refined, and brought up to workbench production at each lab location. The optimizing criteria determined for each unit process will be provided daily to the system modeling platform we will operate at the University of Florida computer engineering center on our own servers in collaboration with http://www.cpe.eng.ufl.edu engineers. Laboratories assets available for collaboration in Florida include: http://www.caslab.com/Jacksonville-Laboratory/ ; https://aellab.com ; http://flenviro.com/fsestemp3.html ; http://www.flowerslabs.com/Apps/WebObjects/FCLSite.woa ; https://www.thorntonlab.com ; http://www.intertek.com/petroleum/florida-alabama/ ; https://www.engsys.com/contact-us/florida-fort-myers ; http://www.emsl.com, ; https://www.thomasnet.com/profile/30818103/eag-laboratories.html?heading=42631200&what=Research+%26+Testing+Laboratories&cov=FL ; https://www.chem.fsu.edu/facilities.php?facility_id=15&info=details, ; http://www.platformspecialtyproducts.com, http://www.synquestlabs.com, ; https://www.toxstrategies.com, http://www.axochemical.com

The FTTA – Institutional Collaboration Structure: FTTA will fund collaboration agreements with LHRI at USC, UFL, and 7 local commercial labs, in return for their technical and facility support.

Structural Advantage of Technology Benefits: The H2H™ & S2J™ 'factories' can be miniaturized due to their greatly reduced heat requirements< 300˚ C. versus ~1300˚ C.+] & pressure needs [20 atms versus 80 atms]. The 40' shipping-container-sized 'factory module' supports rapid, graduated, self-financing production capacity ramp up in locations far flung from the originating factory.

To ensure long-term durability [impervious to constant management of high-solvency Chloride, Fluoride, & related low-melting salts requires specialty pipes / drums / valves & pumps], FloChem America will build these modules from a super-alloy -- either 64% Fe & 36% Ni based **INVAR** [a low thermal expansion coefficient supports high precision H_2 valves, etc.] or 47% Ni, 22% Cr, 18% Fe & 9% Mo, etc. based **Hastelloy X** [exceptionally resistant to stress-corrosion cracking in petrochemical applications at up to 870˚ C., with ease of fabrication, readily formed by cold-working].

Once all unit processes of H2H™ & S2J™ are optimized, a detailed engineering design must be commissioned from the machine design criteria of the process flow analyses. FTTA seeks a number of experienced machine design engineering firms that have significant knowledge bases to compete for this detailed engineering design commission. **See**: https://www.altair.com/product-engineering/ www.mwhglobal.com , http://www.sae-inc.com/c/machine-design--build , http://www.accmach.com/engineering/ , http://www.sabold.com , http://www.matrixengrg.com/services.html .

FTTA is focused on small- to intermediate-sized specialized alloy production & machine manufacturing capacities. The timely rollout of H2H™, Coal-Cleaning, & S2J™ MSCP processes [A.] fine-tuning all unit processes simultaneously in multiple labs, [B.] feeding a full-specification machine design blue print, [C.] executed simultaneously in multiple machine manufacturing facilities situated in the Midwest U.S. along the Mississippi River will assure consistent performance reliability of [1.] the chemistry, [2.] the machinery's functionality, [3.] the ease of operations, [4.] transparent troubleshooting supported on-line by FTTA, & [5.] ready repair. FTTA will build a '**COMMON & ACCURATE KNOWLEDGE BASE**' for all participating skill-sets and keep it up online to support all field operating teams 24 x 7.