TID Micro and Mobile Refining

WELLHEAD AND LOCAL PROCESSING OF CRUDE AND CONDENSATE INTO HIGHER VALUE PRODUCTS
Micro and Mobile Refining

Table of Contents

TID’s Technological Advantage 3-8
Economics 10-18
Revenue Maximizing Process Fabrication Options 20-22
TID’s Process Intensification Experience 24-29
Contact Information 30
TID’s Technological Advantage

How we deliver
Process Intensification

FEATURES
- Proprietary Intensification Zone Technology
- Modular
- Higher quality outputs
- Improved HSE profile
- Increased profitability
- Strategic flexibility

APLICATIONS
- Refining
- Petrochemicals
- Gas to liquids
- Pharmaceutical

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The Science at the CORE of TID’s CUBE Capabilities

Process Intensification
“disproportioned output volume to physical size”

- Utilities
- Kinetics
- Catalyst
- Control

Intensification ZONE®

TID’s:
- Capital Lease Program
- Intensified Chemistry
- Expandable Modular Process Engineering
- Field Installation
- Contract Operation
TID DELIVERS:
Commercial-Scale Chemical Production at Pilot-Scale Size and Cost
by utilizing our
Patented Process Intensification Technology

THE BENEFITS OF PROCESS INTENSIFICATION
Dramatic Cost Savings (Capex & Operational)

High Product Purity
High Product Selectivity
Safer Processes
Optimized Operational Efficiency
Smaller Equipment/Plant
QbD (Quality by Design)
Short Time To Market
Less Waste/By-Products

Technology

- TID’s transformational value proposition is enabled by our patented process intensification IP. This proprietary technology exploits breakthrough control, catalysts, kinetics and utilities to give TID customers an unequalled competitive advantage.
- TID’s technology DOES NOT not presume to change the laws of chemistry or physics. It does however, represent the linchpin inputs that determine the relative efficiencies of all chemical reactions.
- Using its Intensification ZONE®, utilities, kinetics, and catalysts are focused and controlled in a way that emulates lab scale efficiencies for commercial-scale outputs.
We Do Process Intensification Better Than Anyone Else

**Core Competencies**

- Intensification Method Specific Chemistry Research & Development
- Modular, Micro Manufacturing & Automated Process Control Engineering
  - TID Modular Process Fabrication
  - TID Process Site Installation
  - TID Process Technical Support & Contract Plant Operation
TID’S VALUE PROPOSITION

- The CUBE is a true disruptive technology—It’s Intense!

- The TID value proposition increases a customer’s net profit between 25% and 100%.
- No risk to the customer or investors to remove barriers to adopting the technology.
- TID provides the proprietary technology and IP.
- Customer delivers existing demand from the market.
- The CUBE solution provides customers with strategic options to (a) exploit economic rents or (b) become a cost and price leader.
- A disruptive technology that enables customers to backward or forward integrate at will.
Seem too good to be true?

We guarantee our deliverables.

- Customers have **NO** capital risk if TID fails to deliver
- Profit – Our profit interests are paralleled – We only PROFIT when you do
- Growth – Organic & Horizontal
- Compete with a cost advantage that can be converted into added profit or market share
Economics
TID’s Intensified Process Vs. Conventional

an actual scale comparison

TID IP {v 1.0} Refining Module Vs. a Conventional Refinery

<table>
<thead>
<tr>
<th>Process Scale</th>
<th>TID IP (v 1.0)</th>
<th>Conventional Refining</th>
</tr>
</thead>
<tbody>
<tr>
<td>bbl./day</td>
<td>2,000</td>
<td>300,000</td>
</tr>
<tr>
<td>gallons per day</td>
<td>84,000</td>
<td>12,600,000</td>
</tr>
<tr>
<td>gallons/minute</td>
<td>58</td>
<td>8,750</td>
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</tbody>
</table>

**Physics**

| Process pipe size inches (avg) | 3             | 228                   |
| Process pipe size cm (avg)     | 7             | 579                   |

*Actual Relative Scale Comparison*
TID’s Intensified Process Vs. Conventional capital efficiency that’s facilitating a new business paradigm

Until TID’s Process Intensification Technology, the capital efficiency of a small platform refining operation made commercialization an unattainable “need”.

Today, plant specific petrochemical supply chain disruption, local refined product supply and mobile refining are all a reality.

Welcome to a new petrochemical paradigm. Welcome to TID.
**Process Intensified Vs. Conventional**

*an actual chemical comparison*

<table>
<thead>
<tr>
<th>Chemistry</th>
<th>TID IP {v 1.0} Refining Module Vs. a Conventional Refinery</th>
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</thead>
<tbody>
<tr>
<td>Crude pretreatment</td>
<td><strong>TID IP Rationalization</strong></td>
</tr>
<tr>
<td>IP {flex crude-treatment}</td>
<td>Desalted operations is the determining precursor for refining success and efficiencies. TID’s Flex Crude-Treatment technology separates, analyzes and optimizes each critical process step to broaden our customer’s crude use options and overcome conventional desalted limitations.</td>
</tr>
<tr>
<td>Process</td>
<td><strong>Electrostatic</strong></td>
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<tr>
<td>Consistent, high-quality distillate feed</td>
<td><strong>Desalted</strong></td>
</tr>
<tr>
<td></td>
<td>Inline QA/QC</td>
</tr>
<tr>
<td></td>
<td>Aqua-Sol Centrifugal</td>
</tr>
<tr>
<td></td>
<td>Wash</td>
</tr>
<tr>
<td></td>
<td>Inline QA/QC</td>
</tr>
<tr>
<td></td>
<td>Low HLB surfactant option</td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>High HLB surfactant option</td>
</tr>
</tbody>
</table>
## Process Intensified Vs Conventional

*a base engineering comparison*

<table>
<thead>
<tr>
<th>Engineering</th>
<th>TID IP (v 1.0)</th>
<th>Conventional Refining</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmospheric Distillation</td>
<td>Crude Distillation Unit (CDU)</td>
<td>Crude Distillation Unit (CDU)</td>
</tr>
<tr>
<td>Design Basis</td>
<td>McCabe–Thiele</td>
<td>Various</td>
</tr>
<tr>
<td>Reflux cooling</td>
<td>Heat Exchanger or Cryogenic</td>
<td>Heat Exchanger</td>
</tr>
<tr>
<td>Total Number of Trays</td>
<td>25-30 &quot;Total&quot; Shelves</td>
<td>25-34 Total Shelves</td>
</tr>
<tr>
<td>External Size</td>
<td>3”Dx30’H</td>
<td>19”Dx90’H</td>
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</tbody>
</table>

*Post Atmospheric Distillation Processes*

<table>
<thead>
<tr>
<th>Vacuum Distillation</th>
<th>Design Capacity</th>
<th>160,000 bbl.</th>
</tr>
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<tbody>
<tr>
<td>Reflux cooling</td>
<td>Heat Exchanger or Cryogenic</td>
<td>Heat Exchanger</td>
</tr>
<tr>
<td>External Size</td>
<td>3’Dx30’H</td>
<td>46”Dx164’H</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Design Vacuum Range</th>
<th>10-40 mmHg</th>
<th>10 to 40 mmHg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tray Engineering</td>
<td>Proprietary</td>
<td>Various</td>
</tr>
<tr>
<td>Packing</td>
<td>Proprietary</td>
<td>Various</td>
</tr>
</tbody>
</table>

*Customized for customer's needs*
## Process Intensified Vs. Conventional

*an actual scale comparison*

**Custom Engineering Options**

<table>
<thead>
<tr>
<th>TID IP {v. 1.0}</th>
<th>Conventional Refining</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catalytic reforming</td>
<td>Catalytic reforming</td>
</tr>
<tr>
<td>Alkylation</td>
<td>Alkylation</td>
</tr>
<tr>
<td>Isomerization</td>
<td>Isomerization</td>
</tr>
<tr>
<td>Distillate hydro treater</td>
<td>Distillate hydro treater</td>
</tr>
<tr>
<td>Merox</td>
<td>Merox</td>
</tr>
<tr>
<td>Amine gas treater, claus unit</td>
<td>Amine gas treater, claus unit</td>
</tr>
<tr>
<td>Fluid catalytic cracking (FCC)</td>
<td>Fluid catalytic cracking (FCC)</td>
</tr>
<tr>
<td>Hydrocracker unit</td>
<td>Hydrocracker unit</td>
</tr>
<tr>
<td>Visbreaker</td>
<td>Visbreaker</td>
</tr>
<tr>
<td>Delayed coking</td>
<td>Delayed coking</td>
</tr>
</tbody>
</table>
Modularizing the Petrochemical Value Chain

Added Value Chain

- TEXTILES
  - foams
  - upholstery
  - fabrics
  - fabric coatings
  - Gortex
- SAFE FOOD SUPPLY
  - beverage bottles
  - plastic packaging
  - food trays
- TRANSPORTATION
  - car seats
  - belts and harnesses
  - car tires
  - brake pads
  - windshield
- HOUSING
  - paints
  - resins
  - siding
  - fiberglass
  - adhesives
- RECREATION
  - athletic footwear
  - protective equipment
  - bicycle parts and tires
  - camera and film
- COMMUNICATIONS
  - pens, pencils
  - sticky notes
  - paper products
- HEALTH AND HYGIENE
  - plastic containers
  - sunglasses
  - detergents
  - pharmaceuticals
  - toothbrushes
  - toothpaste

Petrochemical Value Chain Diagram
Production Yield

- **Light Sweet** (e.g., WTI, LLS, Brent):
  - Characteristics: > 34 API Gravity, < 0.7% Sulfur, 35% Demand, Most Expensive
  - Inherent Yields: 3%, 32%, 30%, 35%

- **Medium Sour** (e.g., Mars, Arab Light, Arab Medium, Uralis):
  - Characteristics: 24 to 34 API Gravity, > 0.7% Sulfur, 50% Demand, Less Expensive
  - Inherent Yields: 2%, 24%, 26%, 48%

- **Heavy Sour** (e.g., Maya, Cerro Negro, Cold Lake, Western Canadian Select):
  - Characteristics: < 24 API Gravity, > 0.7% Sulfur, 15% Demand, Least Expensive
  - Inherent Yields: 1%, 15%, 21%, 63%

**2009 U.S. Refinery Production**
- 9% Refinery Gases
- 46% Gasoline
- 36% Distillate
- 9% Heavy Fuel Oil & Other

Source: EIA Refined Production

**Characteristics**

1. > 34 API Gravity
2. < 0.7% Sulfur
3. 35% Demand
4. Most Expensive

**Inherent Yields**

1. 3%
2. 32%
3. 30%
4. 35%

**Medium Sour**

1. 24 to 34 API Gravity
2. > 0.7% Sulfur
3. 50% Demand
4. Less Expensive

**Inherent Yields**

1. 2%
2. 24%
3. 26%
4. 48%

**Heavy Sour**

1. < 24 API Gravity
2. > 0.7% Sulfur
3. 15% Demand
4. Least Expensive

**Inherent Yields**

1. 1%
2. 15%
3. 21%
4. 63%
The future of petroleum product exports is growing rapidly among global markets. The U.S. continues to also demand increased petroleum products exports.

U.S. petroleum product exports continue to increase. Total U.S. petroleum product exports continued to increase in 2015, up 467,000 barrels per day (b/d) from 2014 to 4.3 million b/d, driven by increased exports of distillate fuel, motor gasoline, and propane. Mar 25, 2016
The Middle East and CIS are likely to strengthen their positions as net exporters, while Europe, Latin America, Asia-Pacific countries and Africa will import more.
Revenue Maximizing Process Fabrication Options
CRUDE MODULE PROCESS OPTIONS

We’ll deliver your customized modular solution

Present your process/product needs or wants
TID’s mobile refining solutions include:

• ADU (Below)
• VDU
• Triple Step Desulfurization, Desalting and De-Emulsification Unit
• Hydrogenation Unit
• Cracking Units

• Each unit is mounted on a transportable semi trailer for short-to-long-term use at the well-head.
ALL-IN-ONE 2000 BPD CRUDE OR DISTILLATE REFINING SOLUTION

TID’s modular refining process designed with our turnkey:

- ADU
- VDU
- Triple Step Desulfurization, Desalting and De-Emulsification Unit
- Hydrogenation Unit
- Cracking Units
TID’s Process Intensification Experience
Petrochemical Chemical Companies Served

- EXXONMobil
- Valero
- PDVSA
- Ashland
- Sunoco
- Philadelphia Energy Solutions
THE SUCCESS Based Evolution of TID’s Commercial Process Intensification

Micro Modular Reaction Platforms

- IL, USA: 96M tonne/year. Sold to Ciba Chemical (Now BASF)
- IL, USA: 10M tonne/year. Sold to Allied Colloids/Ciba (Now BASF)
- CA, USA: 96M tonne/year. Sold to Ciba Chemical (Now BASF)
- MA, USA: 50M tonne/year. Sold to Delta Searsport (Now GAC)
- MD, USA: 50M tonne/year. Sold to Delta Baltimore (Now USALCO)
- Japan/VA, USA: 26 tonne/year. Mitsubishi Chemical
- MI, USA: 40M tonne/year. Sold to Alchemy Inc. (Owned by SNF)
- GA, USA: Existing technology upgrade & process enhancement. Callaway Chemical (Now Kemira)
- Chile: Technology upgrade and process enhancement. Orica Chile S.A.
- NJ, USA: JDA process enhancements. Watson Pharmaceuticals (Now Actavis)
- MS, USA: 10M tonne/year. Monolyte Labs/PRC Polymers J.V
- MX, USA: 20M tonne/year. Quimica Ecotec (a Cydsa MX Company)
- MS, USA: 55M tonne/year. PRC Polymers
- CA, USA: Technology upgrade and process enhancement. Sapphire Energy
- LA, USA: 20M tonne/year. Monolyte Labs (Sold to Rockwater)
- TX, USA: Technology upgrade/process enhancement. Core-Tech/Haliburton (Now Nalco-Champion)
- IL & IN, USA: Existing technology upgrade and process enhancement. Nalco (Now Ecolab)
- TX, USA: 50M tonne/year Monolyte Labs (Sold to Rockwater)
- TX, USA: 20M tonne/year. Confidential Customer
- TX, USA: 50M tonne/year. Confidential Customer
- TX, USA: 50M tonne/year. Confidential Customer
- TX, USA: 70M tonne/year. Confidential Customer
- Romania: 35M tonne/year (Under Contract)
BUILT FROM EXTENSIVE CONVENTIONAL EXPERIENCE

- Refining with Mobil, ExxonMobil, Valero, Sunoco, PES and Petróleos de Venezuela, S.A. (PDVSA)
- Refining processes –
  - crude atmospheric and vacuum distillation, naphtha reforming (semi-regenerative and continuous), hydro treating (naphtha, distillate, gasoline, and lubricants), hydrocracking, fluid cracking, coking (delayed and fluid), alkylation (sulfuric and hydrofluoric), gas separation, steam-mbase gas(es) reforming, lube production (conventional and catalytic), asphalt manufacturing, aromatics extraction, and petroleum coke gasification
  - Gas to Liquids concept to commercialization
- Offshore technologies for gas and oil production
- Utilities production: Steam, hydrogen, nitrogen, boilers, cooling system
- Research and development of new technologies: Operational conditions, catalysts and technologies evaluation
- Pilot plant design; fabrication and operation for evaluation of new and existing technologies
- Energy integration based design; evaluation of heaters, furnaces and heat exchangers
- HSE Developmental Auditing
- Expertise in on-site and off-site logistics systems
  - crude delivery (marine, pipeline and rail), fuel products (blending, storage, marine and pipeline deliveries), LPG (truck, rail, pipeline, pressurized storage and underground caverns)
- Project experience from initial conception through engineering, procurement, construction and startup
  - recently oversaw construction of largest crude rail unloading facility in North America and largest LPG rail loading/unloading facility on the Eastern Seaboard
- Extensive commercial involvement and optimization of refinery configuration and stream dispositions
- Evaluation of process operational hazard
TID PROCESS INTENSIFIED (PI) MODULES/CHEMISTRY
COMMERCIAL EXAMPLES

- Acrylic Monomers
- Alkyl Amines
- Epi Polyamines
- Quaternary Ammonium Monomer, Polymer
- Peptides, Nucleotides, Antibiotics, and Alkaloids (e.g. Tropinone)
- Agrochemicals, Plant Growth Regulators
- Catalysts
  - Organic
  - Inorganic
  - Organometallic
- Cleaning Applications/Formulations
- Automotive Fuel Treatments
- Epoxy Coatings
- Emulsifiers and DE Emulsifiers
  - Novel Emulsification Chemistries
  - Novel PI Processes
TID PROCESS INTENSIFIED (PI) MODULES/CHEMISTRY
COMMERCIAL EXAMPLES CONTINUED . . .

- Hydrolysis Reaction
  - Initially Via Alloy Catalysis
  - Upgraded to Bio/Enzymatic Process

- Petroleum Distillation
  - Downstream Value Upgrading

- Joint Research Project (Not Yet Commercial):
  - Pharmaceutical Drugs (e.g. Rolitetracycline (the Mannich Base of Tetracycline), Fluoxetine (Antidepressant), Tramadol, and Tolmetin (Anti-Inflammatory Drug) and Azacyclophanes)

- Polymers
  - Water Soluble
  - Plastics Based
  - PAO: IV (1-Dodecene Homo and Copolymers)

- Soap and Detergents

- Syngas Production

- Polyetheramines from Substituted Branched Chain Alkyl Ethers

- α,β-Unsaturated Ketones via The Thermal Degradation of Mannich Reaction Products (e.g. Methyl Vinyl Ketone from 1-Diethylamino-3-Butanone)

- Vinyl Ester Monomers, Polymers
CURRENT INTENSIFICATION PROJECTS

Methane to vPET (via...)

1. Ethylene Oxide (module 1)
   i. Ethylene Glycol (module 2)
   1. Virgin PET (module 3)

2. Hydrolysis of Acrylonitrile
   a. Biologic + Nono-Metallic

3. Acrylic Acid

4. Hydrocarbon Up-Value Processing
   a. Crude Oil Sweetening
      i. Desulfurization
   b. Crude Oil Refining
      i. ADU
      ii. TID Splitter
      iii. VDU
   c. Hydrogenation

5. Fisher-Tropsch based Lube Oils and Wax
   a. I
   b. II
   c. III
   d. III+
   e. F-T Wax

6. Naphtha Value Chain
   a. Targeted Solvent Extraction
      i. Type 1
      ii. Type 2
      iii. Type 3

7. Hydraulic Fracturing Optimized Coated Sand (Silica)

8. Polyacrylamide Synthesis (Dry, Suspension and Emulsion)
   a. EOR Polymer
   b. Friction Reducer
   c. Water Treatment

9. Styrene/1,3-Butadiene Rubber -{x Customer Monomer} Terpolymer

10. Sulfur Destabilization Amine
# Contact

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Email</th>
<th>Main</th>
<th>Cell</th>
</tr>
</thead>
<tbody>
<tr>
<td>James Kane</td>
<td>CEO, CTO</td>
<td><a href="mailto:JIKane@tidipx.com">JIKane@tidipx.com</a></td>
<td>(321) 559-2916</td>
<td></td>
</tr>
<tr>
<td>Bacho Vega</td>
<td>Chief of Staff</td>
<td><a href="mailto:Bacho.Vega@tidipx.com">Bacho.Vega@tidipx.com</a></td>
<td>(321) 559-2916</td>
<td>(480) 307-4774</td>
</tr>
<tr>
<td>Donna Fuller</td>
<td>Senior Marketing Manager</td>
<td><a href="mailto:Donna.Fuller@tidipx.com">Donna.Fuller@tidipx.com</a></td>
<td>(321) 559-2916</td>
<td>(407) 413-4500</td>
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1136 Celebration Boulevard  
Celebration, Florida 34747  
www.tidipx.com