ATP Plant and Upgrader

PRESENTATION TO:

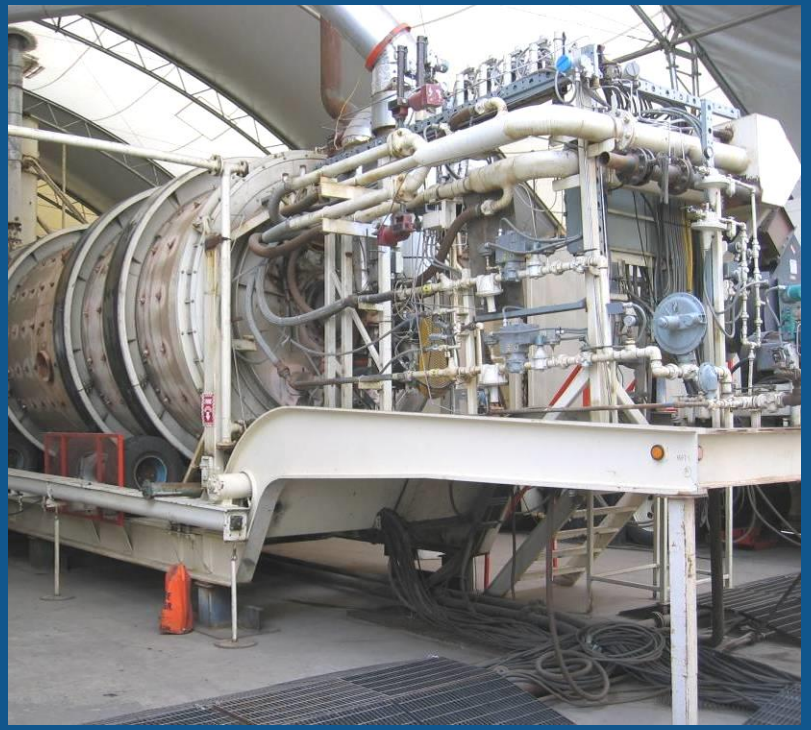
NCUT Upgrading and Refining Conference 2009
Edmonton, AB

September 14-16, 2009

UMATAC Industrial Processes

Overview:

- Based in Calgary, Canada
- Engineering Offices
- Pilot Plant Facility, Laboratory
- Field Technical Services



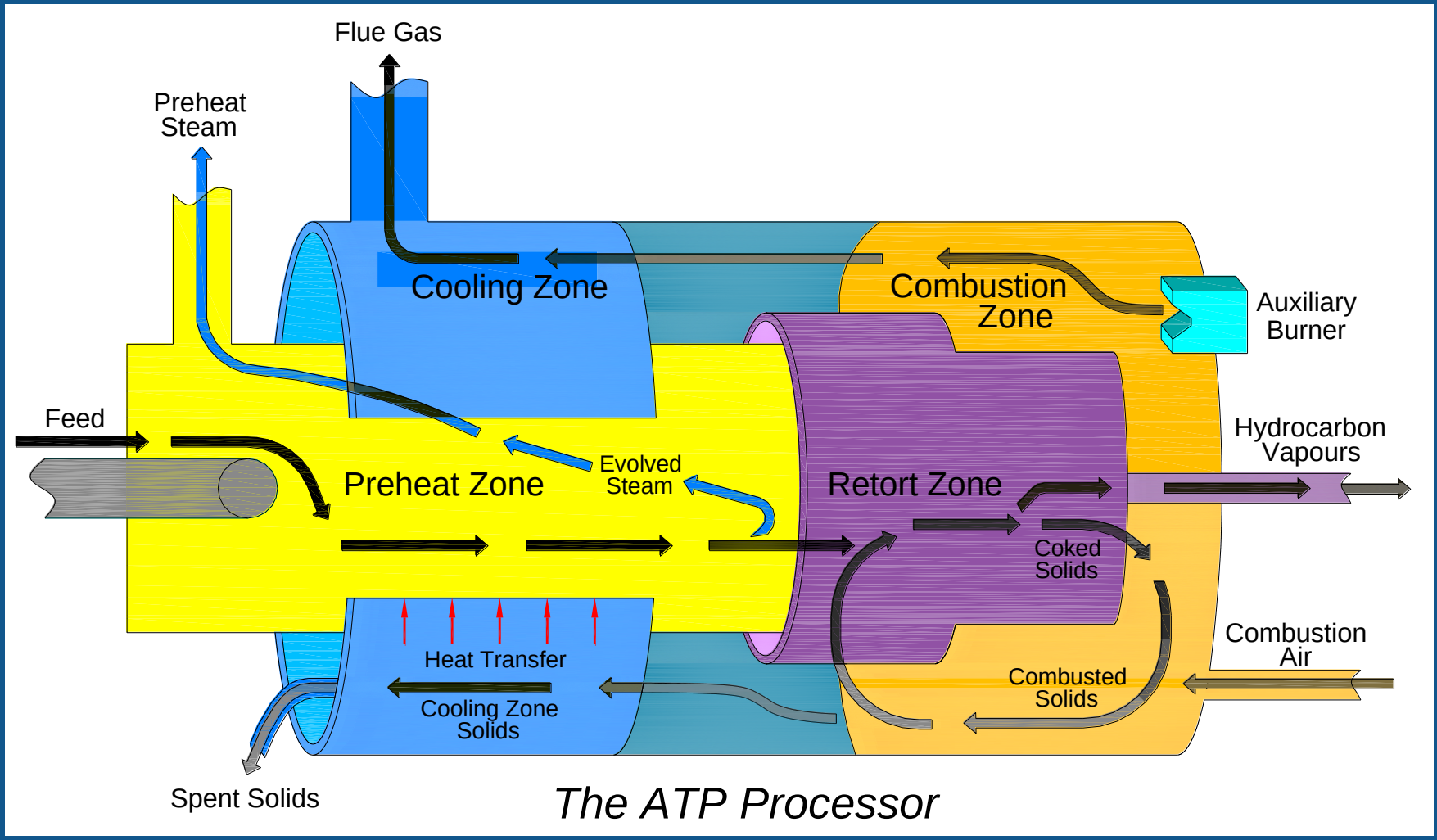
ATP60 Pilot Plant

UMATAC Offers:

- Oil Shale Project Engineering
- Alberta Taciuk Process (ATP) Technology
- Oil Sand, Oil Shale, and Heavy Oil Evaluations
- Specialist Process and Mechanical Engineering
- Cooperation with Polysius AG (a ThyssenKrupp Company) for Rotary Kiln Heavy Fabrication Expertise

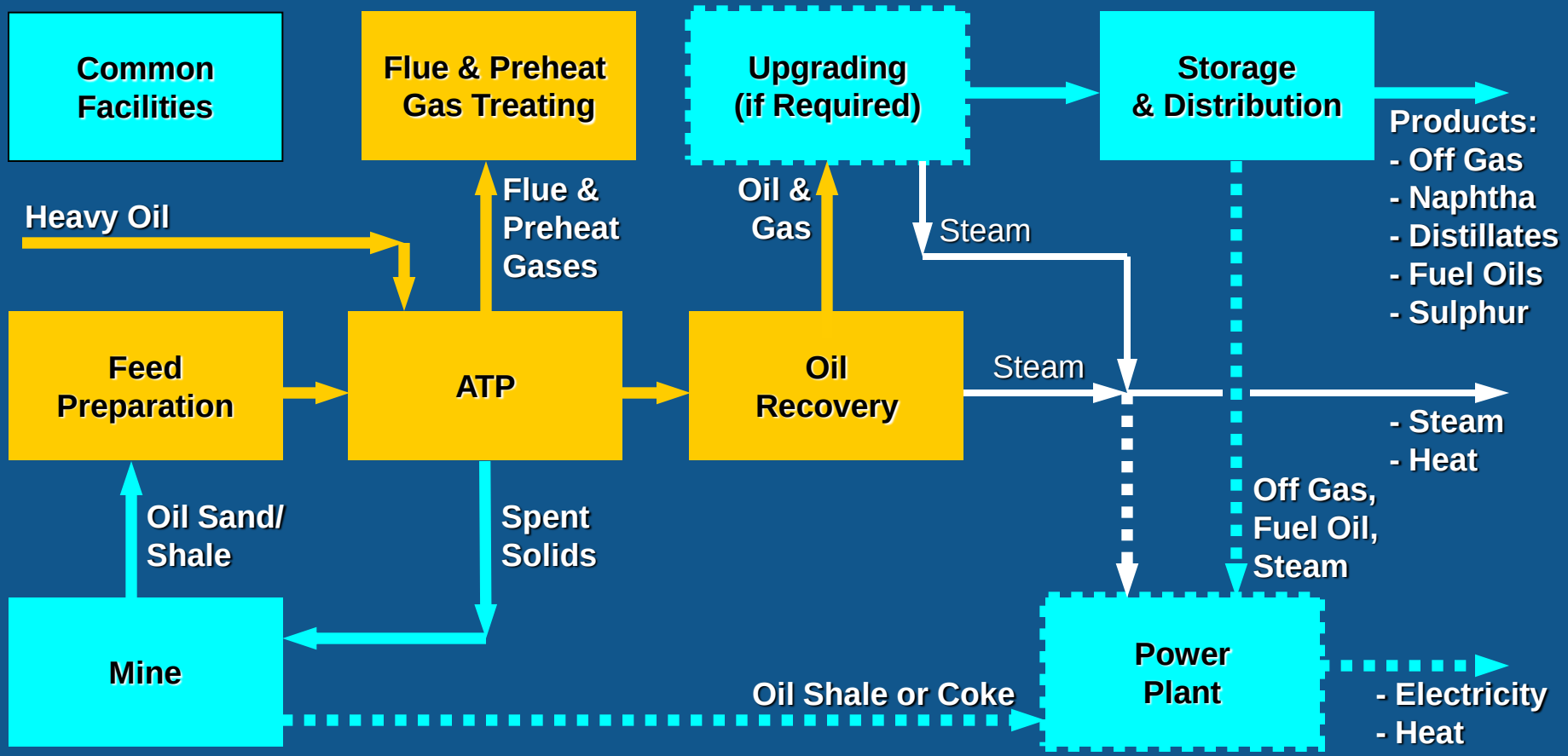
Stuart Australia Plant - 250 t/h ATP Processor Unit

ATP Processor - Schematic



The ATP Processor

Flow Scheme – ATP System and Related Facilities



ATP Technology Development – 34 Years of Experience

1975 UMATAC Inception

1977 AOSTRA Agreement

1978 First ATP Pilot Plant Built

1979

1980

1981

1982 Oil Sand Pilot Studies and

1983 Developing Commercial Plant

1984 Concepts and Cost Estimates

1985

1986

1987

1988

1989 Australia Oil Shale Pilot Studies

1990

1991 ATP60 Pilot Plant Built,

1992 Oil Sand Pilot Studies, and

1993 10 t/h Commercial

1994 Hazardous Waste Clean-up Plant Constructed

1993

1994 Treatability Testing of Oil

1995 Sands and Shales from

1996 Numerous Locations

1997

1998

1999 Stuart Stage I Oil Shale

2000 Demonstration in Australia

2001 - First Major Scale-up

2002

2003 USA, Jordanian, Estonian,

2004 and Chinese Oil Shale Pilot

2005 Testing and Studies

2006

2007 Commercial ATP Plant

2008 Design & Construction in

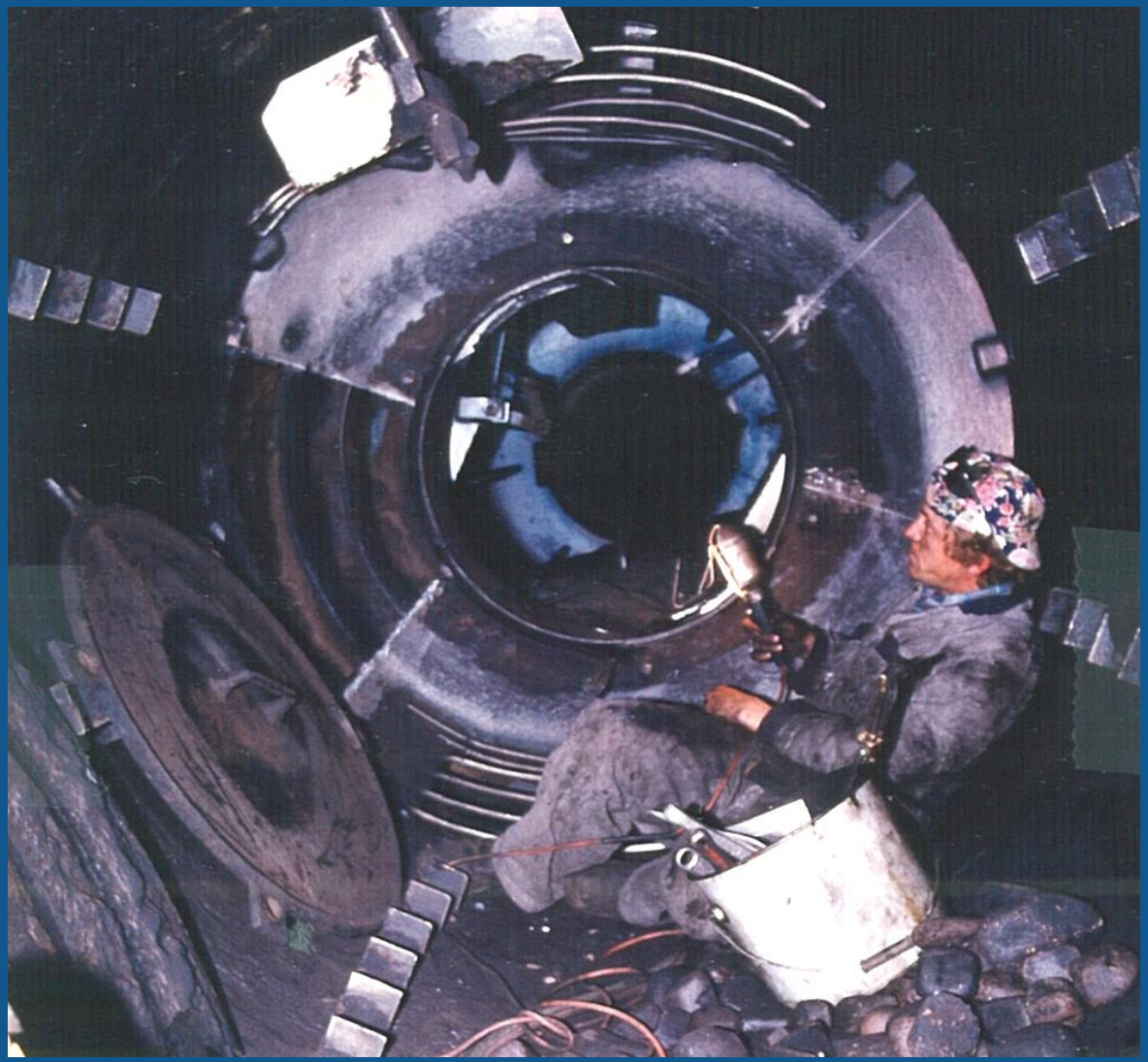
2009 China

2010

ATP Technology Development – 34 Years of Experience

First ATP Pilot Plant Construction – 1977
(William Taciuk on Left)

ATP Technology Development – 34 Years of Experience



1978 to 1994 Oil Sand Piloting

- over 15,000 t, various grades
- over 8,000 h & 500 start ups
- Joint Industry Task Force

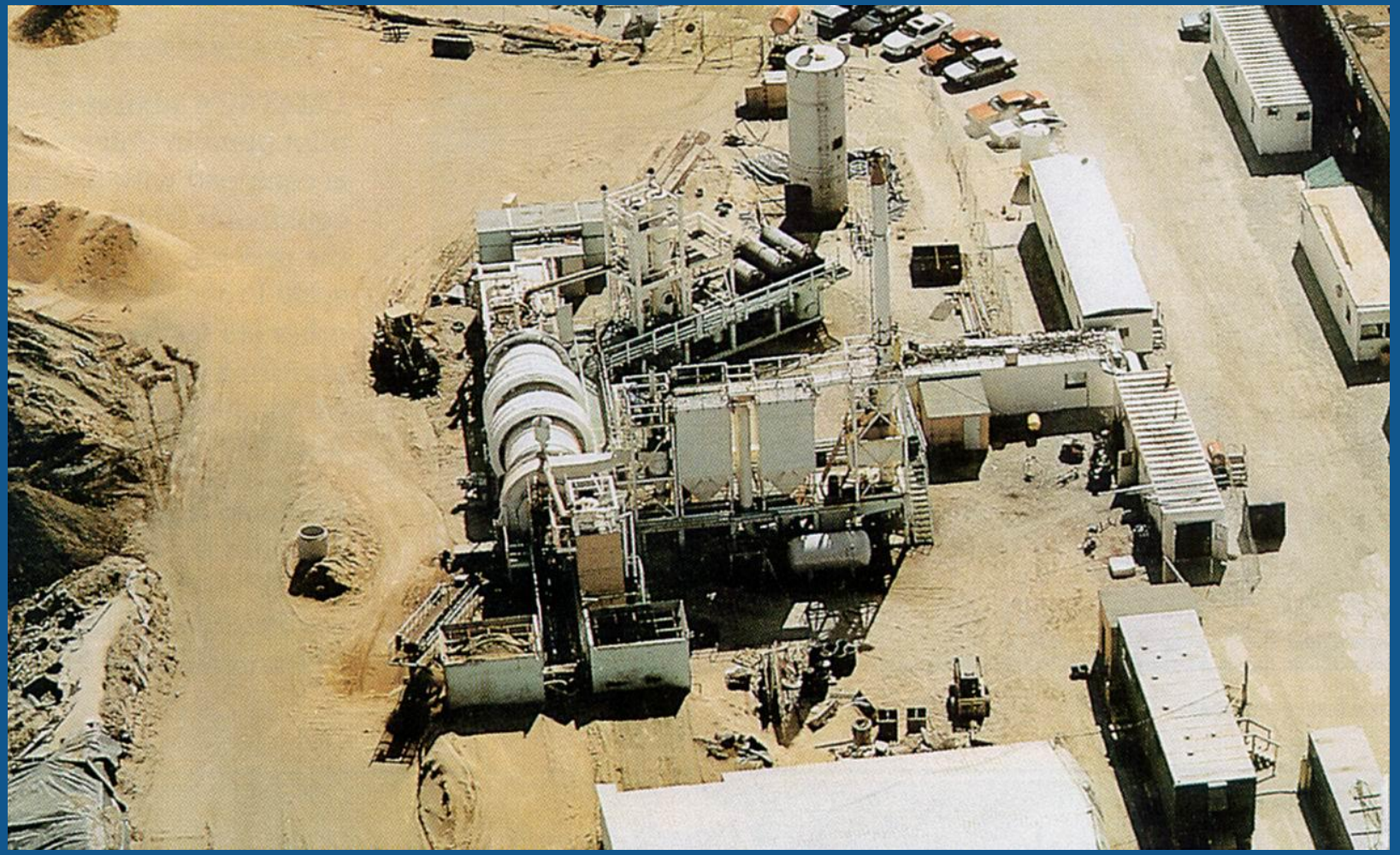
Developing Commercial Plant Concepts and Cost Estimates

1986 to 1991 Australia Oil Shale Piloting and Engineering

First Steps Towards Stuart Oil Shale Demonstration Plant

Preheat Zone Fouling During Oil Sands Piloting, 1982

ATP Mobile Plant – Hazardous Waste Facility



ATP Processor at a Superfund Clean up Site in Michigan

10 t/h unit was used from 1989-1995

ATP Technology Development – 34 Years of Experience

ATP Processor and Hydrocarbon Recovery Plant - Australia

1996 to 2004

Stuart, Australia, 250 tph ATP Demonstration Plant Constructed in 1999 and Operated Until 2004

ATP Technology Development – 34 Years of Experience

ATP Processor Erection in China September 2008

1999 to 2009

Major ATP60 Pilot Plant Test Operations and Commercial Studies for Oil Shales Deposits in:

- USA
- Jordan
- Estonia
- Australia
- China

2009

ATP Facility Currently Under Construction in China

Feasibility Study for ATP Plant Located in Jordan

ATP Technology – Advantages for Oil Sands and Heavy Oil

ATP System Achieves High Yield

- Yield consistent with low, medium, and high grade oil sands.
- Process not sensitive to connate water chemistry, bitumen conditioning, and clays.

Oil Products are Low Viscosity, Bottomed, and Hydrotreatable

ATP System Produces Dry Tailings

- Direct disposal of tailings as backfill in mine (no tailings ponds)

ATP System Scalable & Versatile

- Can be constructed in increments and oil products pipelined to a central or regional upgrader.

ATP Technology – Advantages for Oil Sands and Heavy Oil

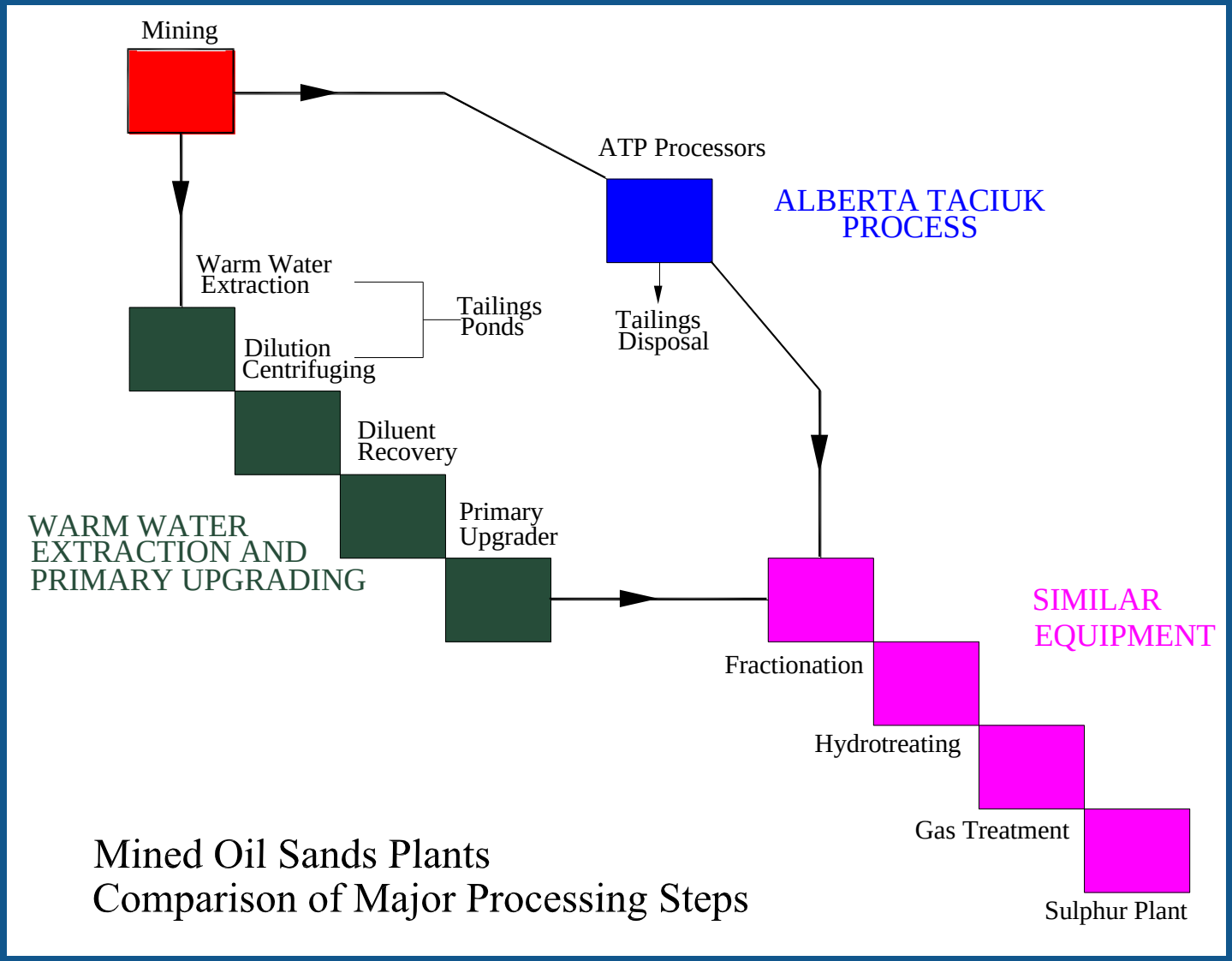
Low natural gas and water requirements

- By-product coke used as primary fuel source (no coke piles).
- Off gas is available as fuel to balance of plant
- ATP water use limited to controlling tailings moisture and process cooling

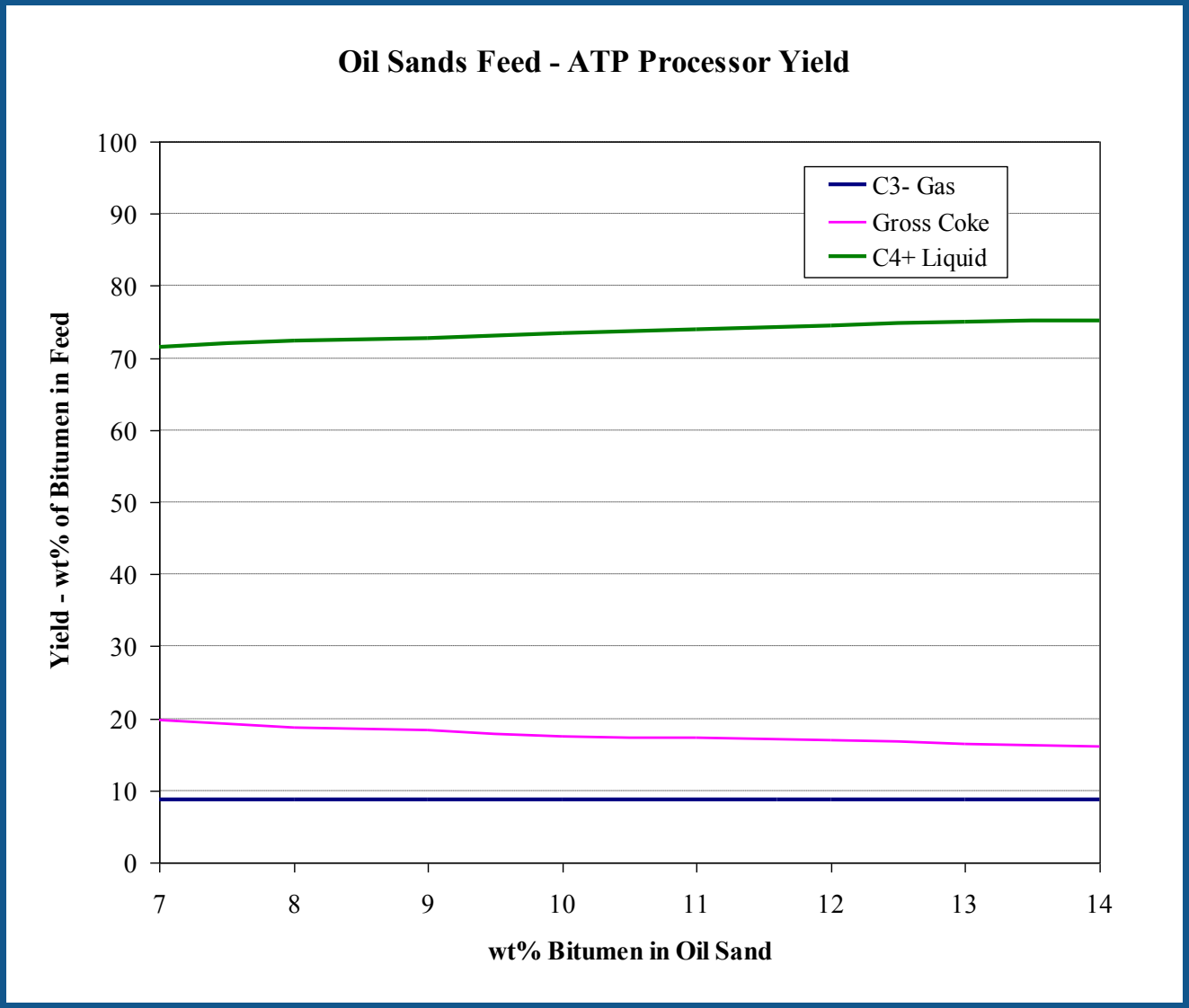
Cost Effective

- ATP System capital and operating costs are favourable compared to existing HWE systems.

Comparison of Major Processing Steps



Oil Sands Yield vs. Grade



Athabasca Oil Sand – Liquid Products Compared

	Bitumen	Fluid Coker TLP	ATP TLP, typical
API gravity	8.0	24	23
S, wt%	4.9	3.5	3.3
N, wt%	0.4		0.2
IBP-204°C	1.6	21.5	23
204-343°C	13.8	32.7	33
343-525°C	37.5	45.8	44
525+°C	47.1	0	0
HYCAL H2, SCF/BBL		886	900-950
	Not pumpable without diluent or upgrading		Pumpable, low viscosity, thermally cracked, bottomed. Hydroprocessing can control stability, S, N

Source: 1982 ATP Test Program

Secondary Upgrading Experience

Oil sands

Gulf & CANMET testing

Stabilization of total liquid product with partial heteroatom removal possible in single stage of hydrotreating

Removal of heteroatoms to WMSCO requires separate heavy and light oil hydroprocessing

ATP naphtha highly cracked, required staged temperature profile in reactors to prevent oligermization

Oil Shale

NCUT studies, Licensor studies, Stuart Operation

Heteroatom Challenge:

- Jordan S (>8% S, all fractions)
- Estonia O (>5% O, high in phenols)
- China N (>1.0% N, ammonia)
- Australia ~ 0.4% S, 0.9% N

Stuart plant produced Certified Jet Fuel using 3 stage hydro-treating with standard industrial catalysts

Stuart Demonstration Plant - Hydrotreating

Shale Oil: Diesel & Naphtha

Upgrading Facility

Hydrotreated Fuel
< 1 ppm S
< 4 ppm N

ATP Technology – Stuart Demonstration Plant Summary

ATP Processor

- Scale-up (75:1) methodology was successful.
- Achieved design throughput and oil yield.
- Operated at 200% of design water load.
- Mechanical design proven to be robust.
- Availability of ATP Processor was high.

Oil Recovery & Upgrading

- Vapour scrubber design and scale-up proven.
- Hydrotreating – industrial catalysts were adequate - high nitrogen removal achieved, unit worked as designed.

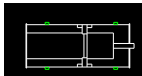
ATP Technology – Recent Process Developments

Scale-up

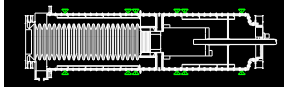
- Proved scale-up 75:1 at Australia Demonstration Plant.
- Similar size ATP being constructed in China.
- Designing 2:1 scale-up for Jordanian 15,000 bbl/d SCO plant.

Larger Capacity Plants Developed In Increments to Reduce Risk

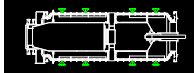
ATP Processor Scale-up 1977 to 2010



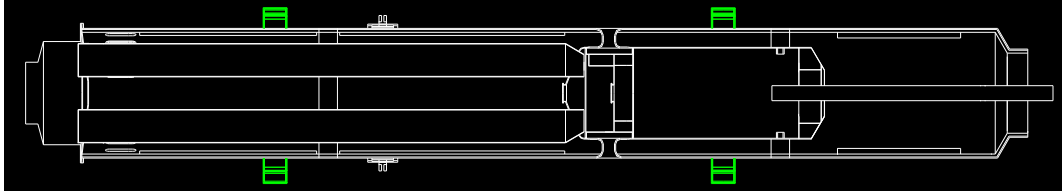
1977 Pilot Plant 5 t/h, Shell 2.8 m dia. x 6.7 m long, 3.1 dia. Tyre



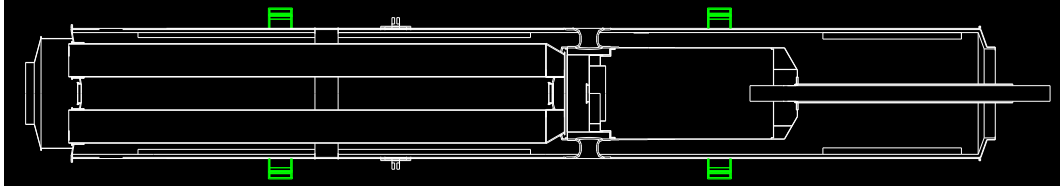
1989 Waste Treatment Plant 10 t/h, Shell 3.7 m dia. x 15 m long, 4.3 m dia. Tyre



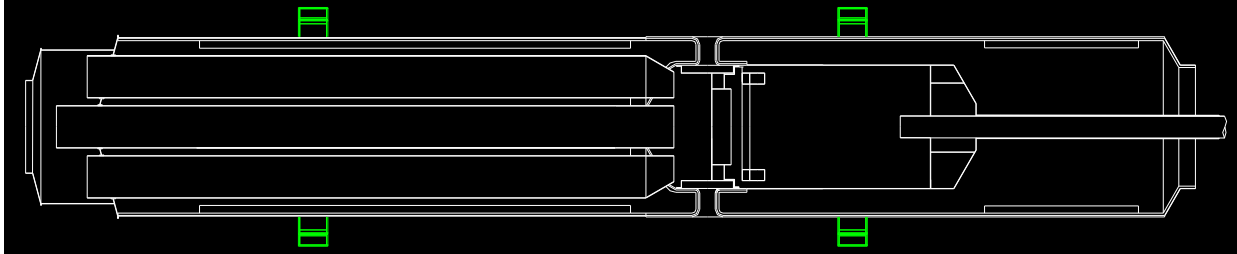
1991 ATP60 Pilot Plant 5 t/h, Shell 3.1 m dia. x 9.3 m long, 3.7 m dia. Tyre



1999 Stuart Demonstration Plant 211 t/h, Shell 8.3 m dia. x 65 m long, 11.1 m dia. Tyre



2008 Fushun Commercial Plant 230 t/h, Shell 8.4 m dia. x 63 m long, 11.1 m dia. Tyre



2010 Jordan ATP Scale-Up 500 t/h, Shell 11.5 m dia. x 76 m long, 15.5 m dia. Tyre

ATP Technology – Recent Process Developments

Increased Thermal Performance

- Previous plants implemented heat recovery from:
  - ✓ Hot solids inside ATP cooling zone (heat recovery from 750 to 400°C).
  - ✓ ATP hydrocarbon vapours (steam generation from hot oils).
- Implementing further recovery of waste heat from:
  - ✓ ATP spent solids (heat recovery from 400 to 150°C).
  - ✓ ATP flue gas (heat recovery from 365 to 150°C).

Result is 15% Lower Fuel Consumption for ATP in China

ATP Technology – Recent Mechanical Developments

Mechanical Scale-up and Support Tyres

- Proved scale-up and mechanical reliability of 8.3 m diameter ATP Processor at Stuart Demonstration Plant – very robust design.
- Proved segmented transport, field welding and machining technique for 11.1 m dia. tyres at FMG plant in China – reduces fabrication and transport restrictions.
- Scale up for Jordanian 15,000 bbl/d plant requires ~15.5 m diameter tyre and 11.5 m diameter shell.

Scale-up Obstacle Removed For Larger Units

Single Piece (top) vs. Segmented (bottom) Tyre Transport – both 11.1 m Diameter

On-Site Tyre Welding & Machining – FMG China

Weld Preparation

On-Site Machining by Self Leveling Machines (SLM)

Current Major Activities

Jordan, Al Lajjun ATP Project Feasibility Study

- ✓ ATP System & Processor Engineering
- ✓ Two 500 t/h capacity ATP trains, 15,000 bbl/d SCO (hydrotreated)
- ✓ Reserves estimate, logistics, oil upgrading, power plant, and environmental studies

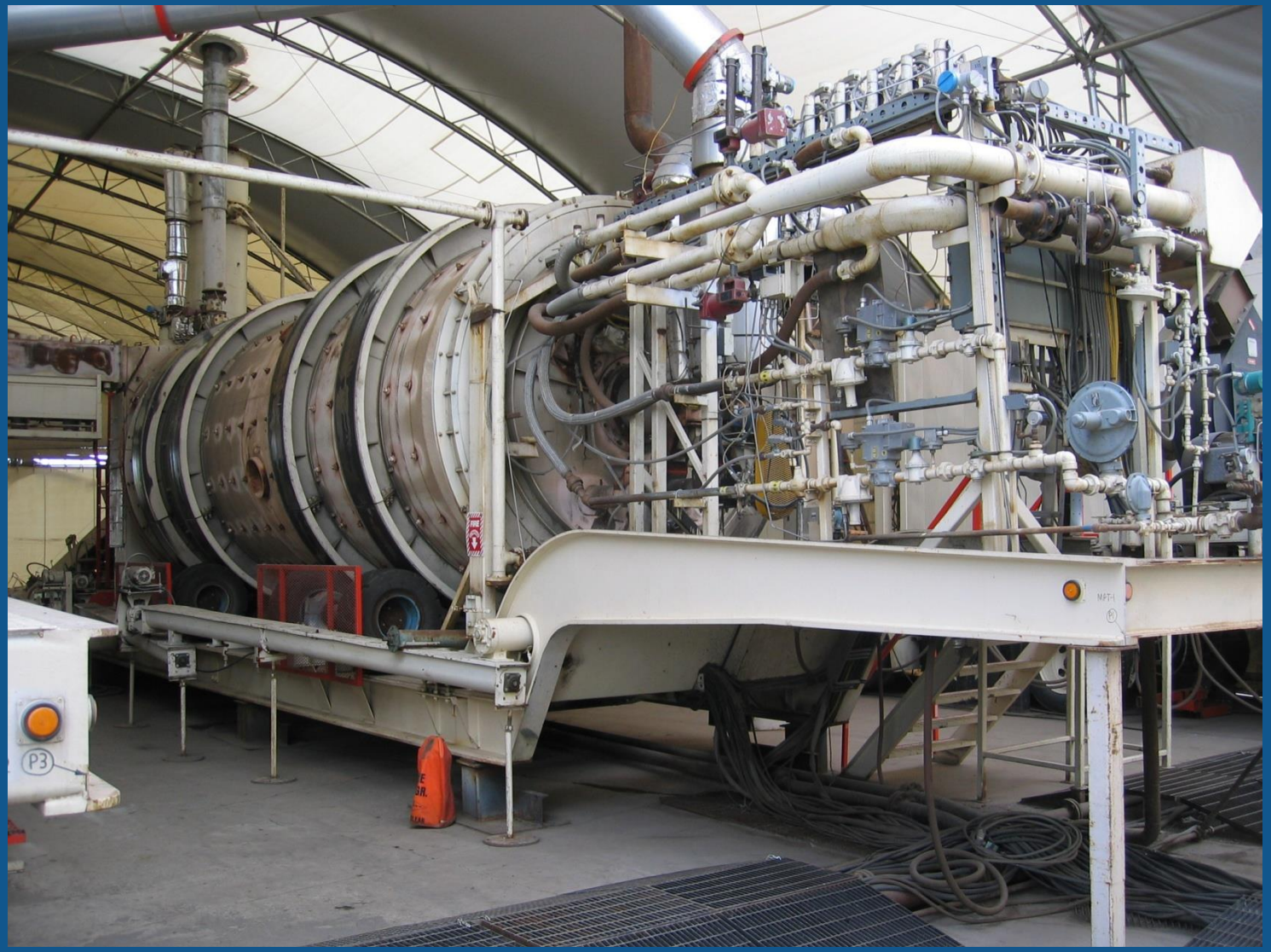
China, Fushun ATP Project

- ✓ ATP Processor fabrication and construction underway
- ✓ Detail engineering and plant construction in progress – commissioning Fall 2009

Ongoing Opportunities and Investigations

- ✓ Oil sands (oil and water wet), oil shales, heavy oil pyrolysis

ATP60 Processor – UMATAC Pilot Plant



ATP60 Processor at UMATAC pilot plant site in Calgary, Alberta

Fushun, China, Construction Photos

ATP Processor Centre Support – Offloading From Ship and Road Transport Inside China (Fabricated in Malaysia)

Fushun, China, Construction Photos

Support Tyre Placed on Outer Shell (Shell Fabricated in China, Tyre Cast in Czech Republic)

Ash Recycle Assembly (Fabricated in Malaysia)

Fushun, China, Construction Photos

ATP Processor in Construction - Outer Shell Erected. Commissioning Fall 2009.

Summary

Developed for Oil Sands

- ✓ Fundamental ATP advantages: thermal processing to a pumpable distillate with dry tailings
- ✓ High recoveries independent of feed characteristics
- ✓ Extensive piloting experience

Proven in Oil Shale

- ✓ Scale-up methodology & new construction methods successful
- ✓ Processor mechanical design proven to be robust
- ✓ Learnings / advances incorporated into new designs

Ready for future opportunities

- ✓ Oil sands (oil and water wet), oil shales, heavy oil pyrolysis.
- ✓ Scalable for diverse applications

Acknowledgements

UMATAC and its staff take this opportunity to thank many members of AOSTRA and ADOE for their assistance in completion of UMATAC's activities from 1977 through 1995. Without the financial support received from the Alberta Oil Sands Technology and Research Authority, the ATP Technology developed and described in this paper would not have been possible.

UMATAC Industrial Processes

UMATAC appreciates this opportunity to present the ATP Technology as it has been developed in the last 34 years. UMATAC is of the opinion that, based on our earlier oil sands test program successes, the ATP Technology could provide an efficient means of overcoming some of the concerns being raised with regard to expansion of the current oil sands industry.

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