

ELLYCRACK

ON-SITE HEAVY OIL UPGRADING TECHNOLOGY

Technology Preview

Oslo, September 2009

Presentation of Ellycrack Technology

- **Background**
- **Introduction to Technology and Innovations**
- **Status and Testing**
- **Business Case**
- **Summary of Key Benefits**

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Background

Ellycrack AS

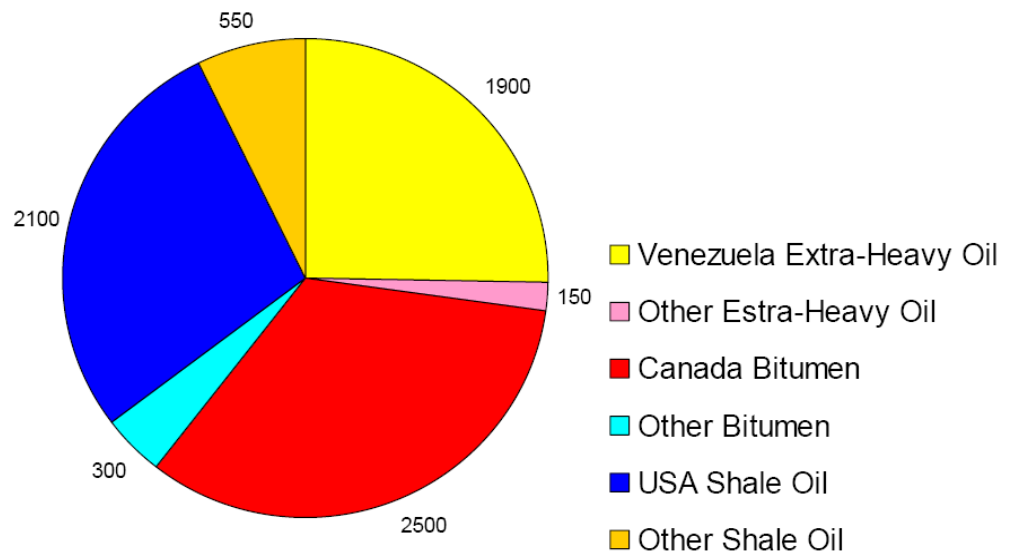
- Incorporated in Norway 2001
- Has about 90 shareholders
- Number of issued shares: 5 384 708
- CEO, Engineer, Olav Ellingsen
- The company subcontract its other needs such as accounting, auditing, financial advisors and legal assistance from case to case.
- Board of Directors
 - Chairman, Master of Science Fritz Wegmann, Zurich
 - Member, lawyer Morten Borch, Oslo
 - Member, marketing investigator Bjarte S. Ellingsen, Oslo
 - Member, Geologist Ph.D Gemma Keaney
 - Member, engineer Olav Ellingsen, Florø

R&D Partners

- **Sintef Energy Research AS, Trondheim, Norway**
 - Professor Jens Hetland
 - Ph.D. Jørn Bakken
- **Nyhavna Mekaniske AS, Norway**
 - Engineer Sig Fuglestad
- **KGD Development AS, Norway**
 - CEO Engineer Roger Gale
 - Professor Finn Drangsholt
- **Saskatchewan Research Council, Saskatoon, Canada**
- **National Resources Canada, Edmonton, Canada**
 - Research institute
- **Bantrel, Edmonton, Canada**
 - Engineering

Heavy Oil Market

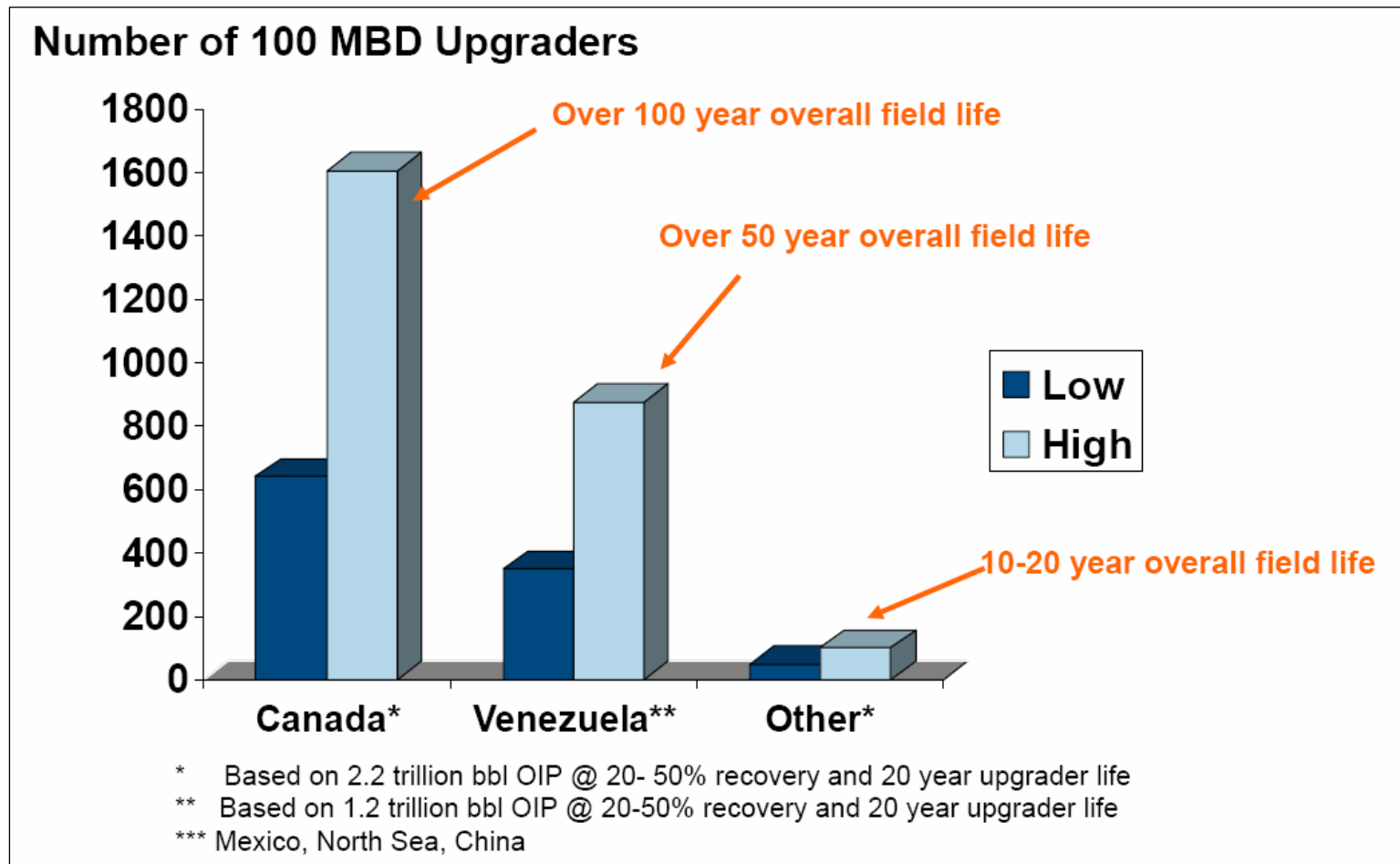
- **2/3 of the world's total oil reserves are heavy oil (*).**
- **86% of heavy oil reserves are located in Canada and Venezuela.**
- **In Canada, heavy oil is produced both from oil wells and from oil sands (bitumen).**



Distribution of the heavy oil reserves (in Billion barrels)

(*) Source: Wikipedia

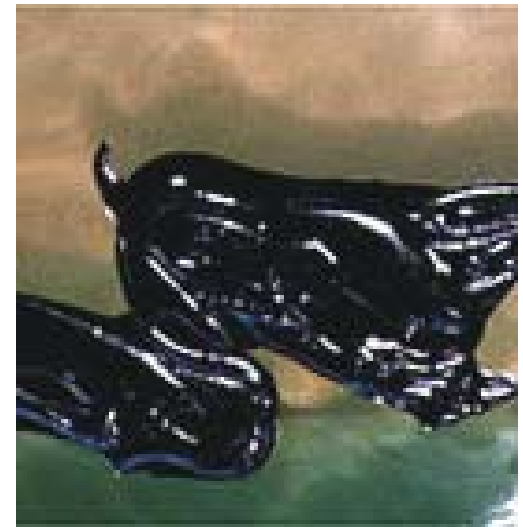
Market For Heavy Oil Upgraders



Source: GE Energy Estimates

Problems Connected With Existing Technology

- **Conventional heavy oil producers:**
 - **Need of light oil (diluent):** Diluents need to be pumped down in the well to be blended under ground before it can be pumped to the surface
 - The blended oil must be upgraded in a cracker before it can be routed to a refinery
- **SAGD (steam based) oil sands producers:**
 - **Need of light oil (diluent):** The warm heavy oil from the well needs to be blended with diluents before it can be pumped to a cracker
 - The blended oil must be upgraded in a cracker before it can be routed to a refinery
- **Conventional crackers require huge capital investments**
- **High output of CO₂**
- **Environmental footprint**



Heavy oil does not flow

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Introduction to Ellycrack Technology and Innovations

What is Ellycrack?

- Ellycrack is a “dry” process for upgrading of heavy oil at the oil field
- Technical feasibility based on:
 - Unique low temperature and low pressure thermo-kinetic process
 - Process equipment known to the industry
 - Small and big size plants built at about the same investment cost per flowing barrel
 - Fitting existing infrastructure in the oil industry
- Ellycrack AS will develop, refine and commercialize this technology, which offers substantial economic and environmental benefits to clients engaged in production of heavy oil

The Benefits of Ellycrack Technology

- **Low capital cost: “investments per barrel per day” at USD 10.000 which is about 1/5 compared with a conventional cracker**
- **Low energy consumption due to low process temperature**
- **Low operating cost: 3-5 USD per barrel**
- **Self supplied with energy: using the generated coke in the heavy oil as fuel**
- **Substantial reduction of CO₂ , Sulfur and heavy metals**
- **No advanced catalysts**
- **Easy to scale up**
- **The plant can be located and upgrade the heavy oil on the oil field - therefore no need for diluents to be transported**
- **The oil can be routed directly to a refinery**
- **Increase the value of oil with 25-30 USD per barrel by upgrading bitumen heavy oil from 8 API to 29 API (*)**

(*) Source: The Canadian Association of Petroleum Producers (CAPP) - from a diagram showing historical price difference between Bitumen heavy oil and West Texas Intermediate, reduced by 5 USD as WTI premium

Ellycrack - How It Works

Simplified Flow Diagram

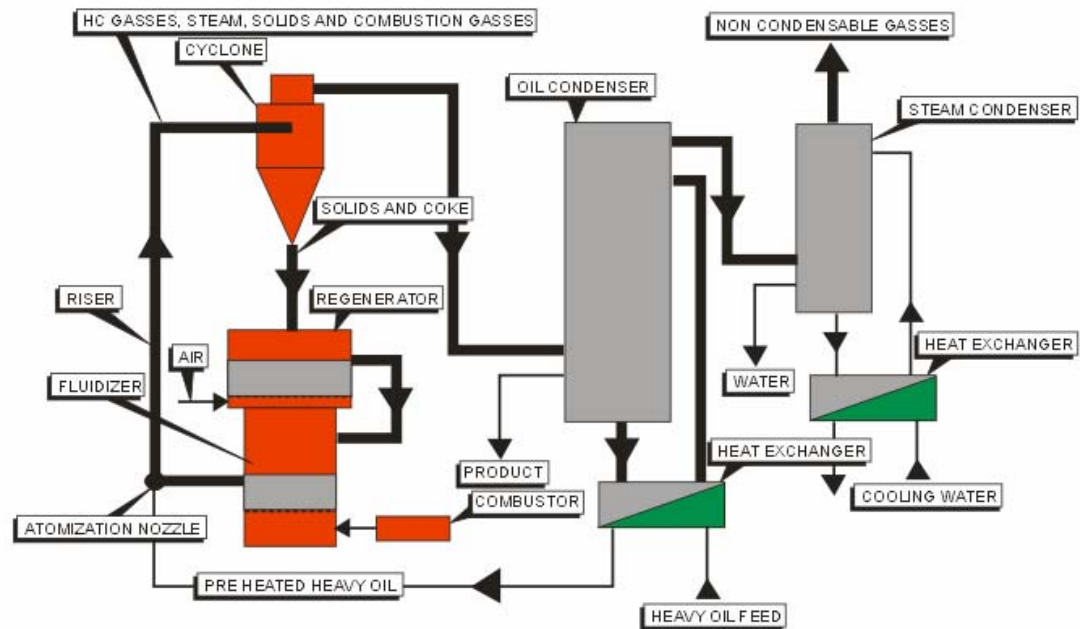
The basic process can be described in 4 key steps:

1. From a regenerator, hot fine divided particles, heated by coke combustion, are pneumatically conveyed into a “collision” riser by hot combustion gasses.

2. Steam atomized, pre-heated heavy oil is injected into the riser and collide with the particles in the riser causing an instant cracking.

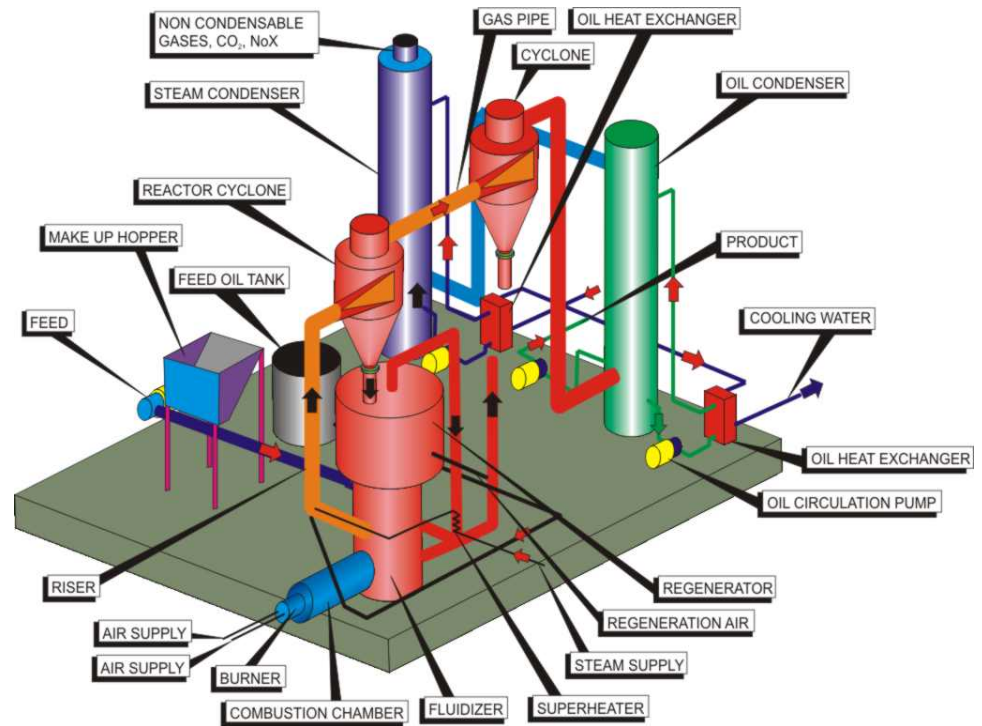
3. In the reactor the solids and generated coke are separated from the stream and routed back to the regenerator, and the oil gas is routed to the oil condenser.

4. The generated coke is used to fuel the process where the solids used as a heat carrier are routed into the fluidizer and riser again in a loop.



Ellycrack Main Components

- Reactor with start up burner
- Cyclone for solids separation
- Exhaust gas heat exchanger
- Solid/gas heat exchanger
- Fluidized gas super heater
- Oil condenser
- Water condenser
- Gas treatment



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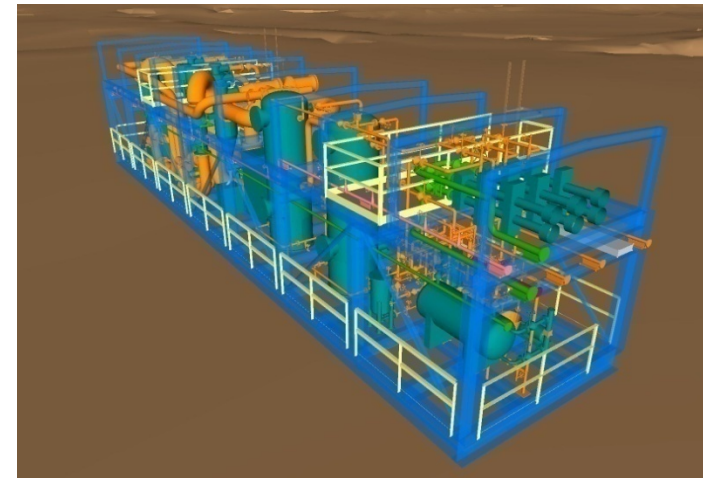
Status and Testing

Development To Date

- Technology developed by Ellycrack AS, Norway
- Test rig built at SINTEF Energy Research, Norway where the concept has been proven with following results:
 - Upgrading oil from 8 API to 29 API
 - 60% reduction of CO2 emissions in the upgrading process
 - 50-60% reduction of Sulfur in the oil
 - 90% reduction of heavy metals in the oil
 - Less than 0,3W% olefins generated
- Test rig moved to Saskatchewan Research Council, Canada for more extensive testing on continuous bases
- One patent granted, one patent pending and three under preparation



Test rig at Saskatchewan Research Council, Canada



GA of a 300 bpd plant designed by Bantrel, Edmonton

Testing Results

MATERIAL	INITIAL API	UPGRADED API	COMMENTS
Pit oil Venezuela PDVSA	6,2	22,5	Collected from a macro pit at San Tome
Crude Venezuela PDVSA	9,3	20	Undiluted crude from Melones
Blended oil from Venezuela, PDVSA	14,9	21,5	Diluted crude from Melones first test
Blended oil from Venezuela, PDVSA	14,9	29,3	Diluted crude from Melones second test
Crude from NORSK HYDRO	18	29,5	Grane Oil Field in the North Sea
Canadian crude SUNCOR	13,18	25,2	Loydminster

CO2 Comparison

- Existing upgraders:

CO2 emissions from gas consumption for upgrading (1):	44 kg/bbl
<u>Production of coke as by-product (2):</u>	<u>146 kg/bbl</u>
Total CO2 generated:	190 kg/bbl

- Ellycrack:

CO2 emissions from coke consumption for upgrading:	16 kg/bbl
<u>CO2 emissions from producing surplus electricity 63,9 kw/bbl (3):</u>	<u>42 kg/bbl</u>
Total CO2 generated:	58 kg/bbl

(1) Source: Canadian Association of Petroleum Producers (CAPP) . Based on average of 0,5-07 Mcf/bbl.

(2) Source: Handbook of alternative fuel technologies. Based on yield 25% w/w which is average both on Delayed coking and Fluid coking of oil 8-10 API (bitumen). The quality of this petroleum coke is poor. Therefore it is mainly deposited .
Now in experiments: to be used as fuel for production of hydrogen for secondary upgrading by steam gasification .

(3) Surplus electricity may be used for generating steam for SAGD-producers.

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Business Case

Business Idea

Ellycrack AS will alone or with an industrial partner develop, refine and commercialize Ellycrack technology, which offers substantial economical and environmental benefits to clients engaged in production of heavy oil.

Ellycrack intend to create value by generating income and profit based on what clients want of either:

- **Production sharing**
- **Licensing**
- **Leasing**
- **Sale of plants**

Strategy

Develop Ellycrack to a stage where the future potential value of the technology is clearly visible. Then search for exit alternatives as sale of company or listing the company on a stock exchange.

Short term strategy:

1. Prepare the pilot plant for new extensive testing
2. Invite heavy oil producers to test their oil on the pilot plant
3. Discuss further commercial issues with these oil producers during the test period
4. Secure sufficient funding to develop the company according to chosen business plan

Summary of Key Benefits

- Eliminate the cost of buying and transporting of diluent oil
- Increasing sale price of oil with USD 25-30 in a single operation at a cost of USD 3-5 per barrel
- Payback on investment for a client between 1 and 2 years
- Easy to fit into existing infrastructure on the oil field
- Reduce emissions from CO₂ consumption with 60%
- Ellycrack represents a high value added factor which reduces business risk significant by securing a higher sale price of the oil