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EST Technology:
the best way to upgrade the Canadian oil sands

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From Oil Sands to Synthetic Crude Oil



Oil Sands:
a combination of clay,
sand, water, and bitumen



Bitumen:
a highly
viscous
mixture of
hydrocarbons



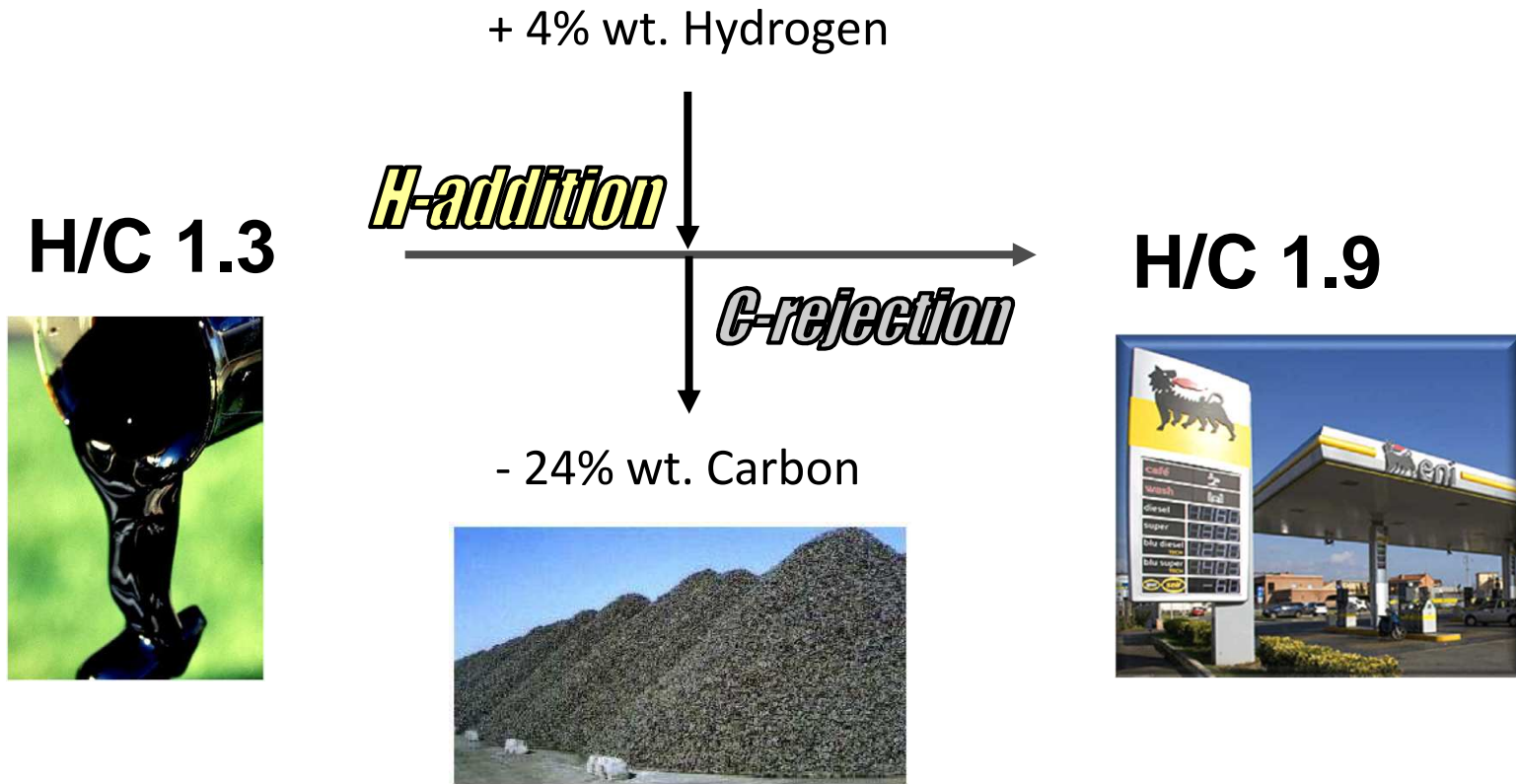
Synthetic Crude Oil (SCO):
a complex mixture of
hydrocarbons obtained from
bitumen upgrading and
somewhat similar to
petroleum



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Bitumen Upgrading Options



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C-rejection

Delayed Coking

- ❑ Low value petroleum coke
 - ✓ Disposal issue
- ❑ Low volume yield
- ❑ Additional upgrading required for VGO fraction
- ❑ “Dirty” products requiring substantial downstream hydrotreating

H-addition

Hydroprocessing

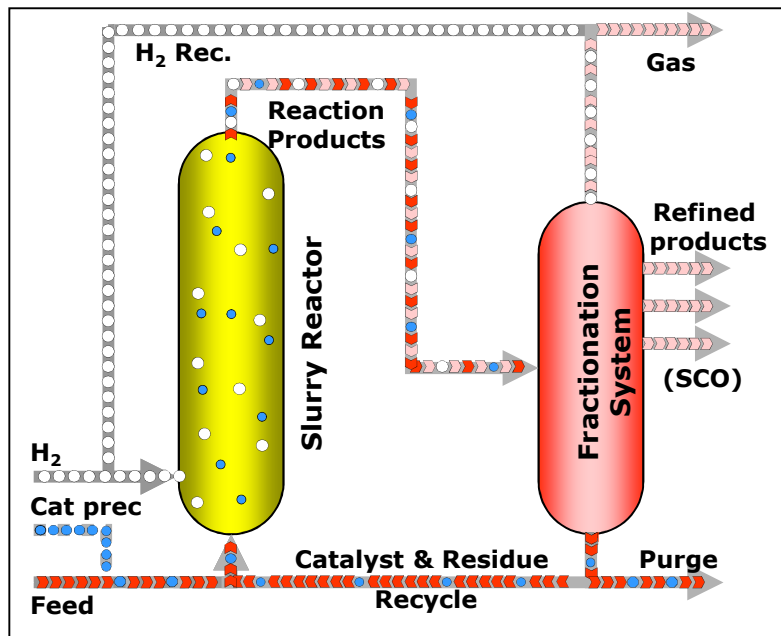
- ❑ High volume yield
- ❑ Clean product production
 - ✓ Limited by-products (dependent on technology)
- ❑ Substantial hydrogen requirement
 - ✓ Production of clean product minimizing downstream hydrogen requirements
- ❑ Capital/Operating cost higher than Coker



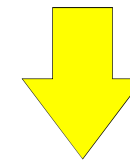
EST: a new solution

EST is a hydrocracking process based on two unique features:

- 1. Nanodispersed (slurry) non ageing catalyst**
- 2. Homogeneous & isothermal slurry bubble column reactor**



recycle of unconverted heavy ends



**overall complete
feedstock conversion (>97%)**

**EST can easily handle very heavy feedstock,
like oil sands bitumen**



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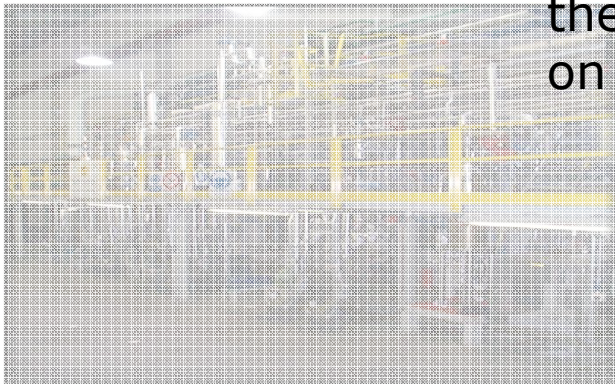
EST: Development Road

early '90

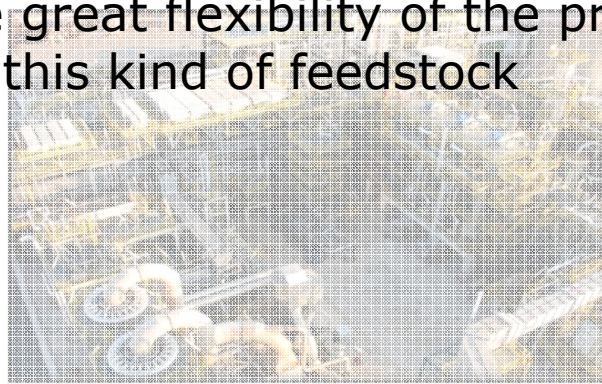
Start of research activities

1999-2002

Construction of the Pilot Plant (San Donato Milanese)



A test run on asphalt from Athabasca Oil Sands has been successfully completed at Taranto Demonstration Plant, confirming the great flexibility of the process on this kind of feedstock



2013

First EST industrial Plant

Sannazzaro EST Project

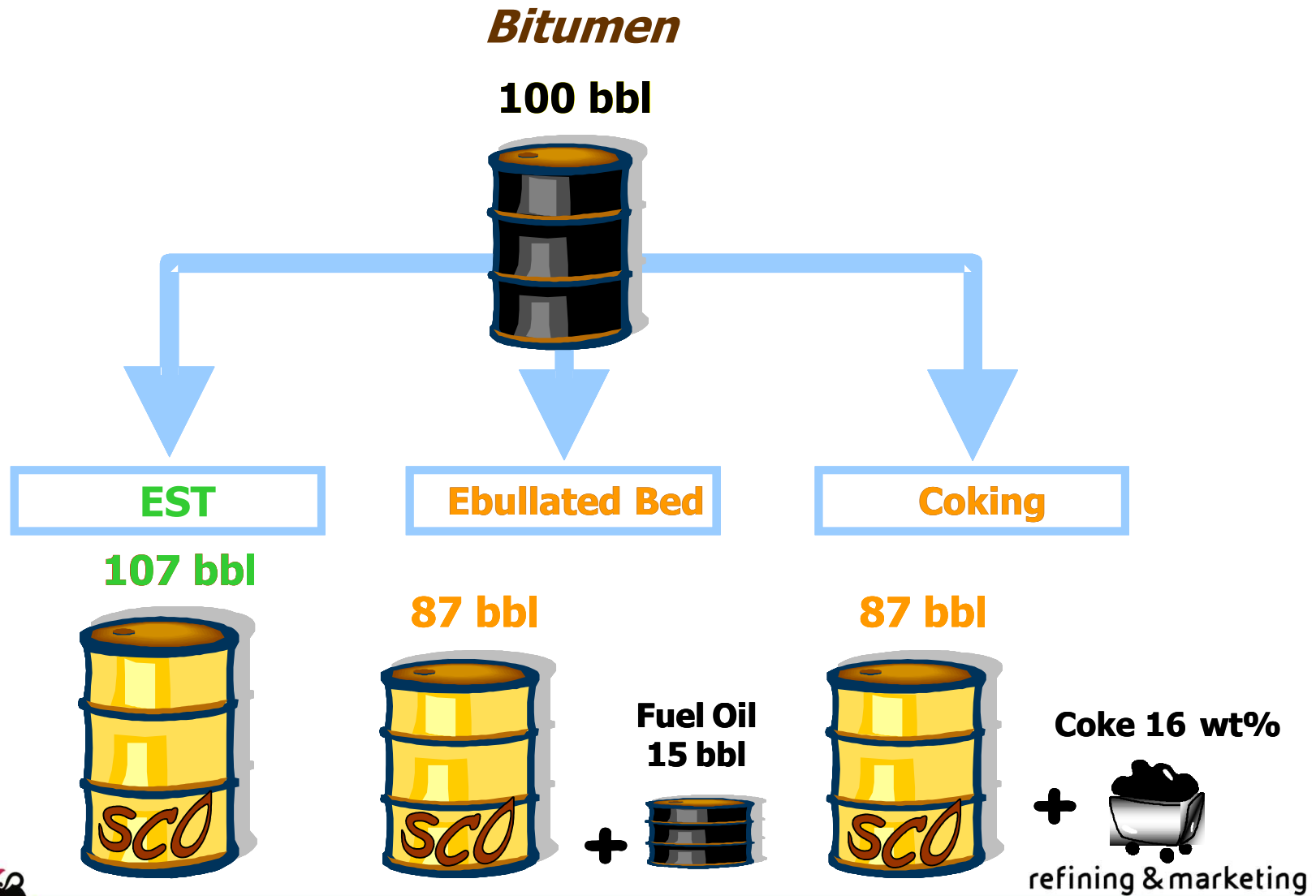
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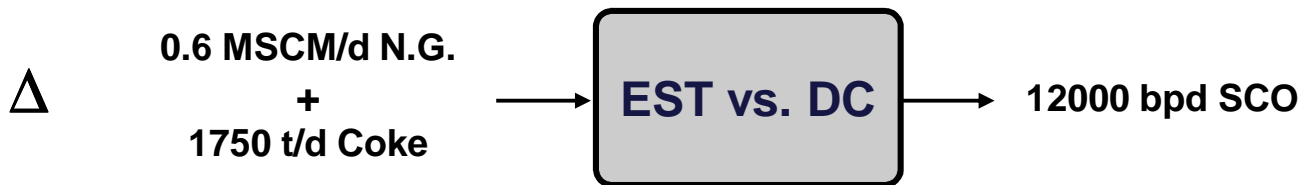
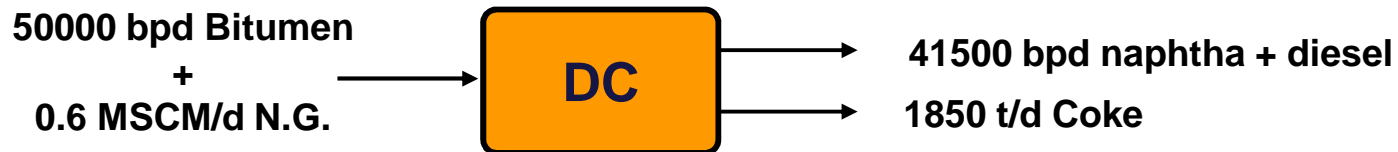
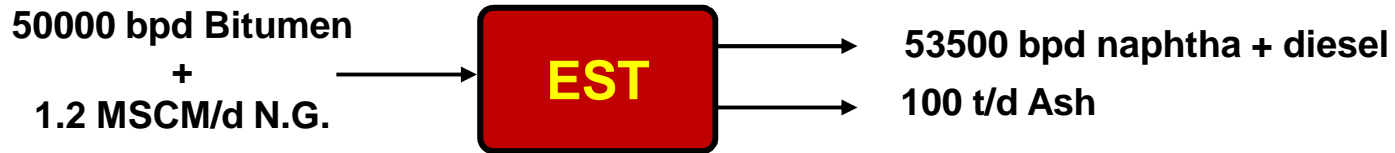
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EST: Total Feedstock Conversion



Case Study – Athabasca Bitumen Upgrading: EST vs. DC

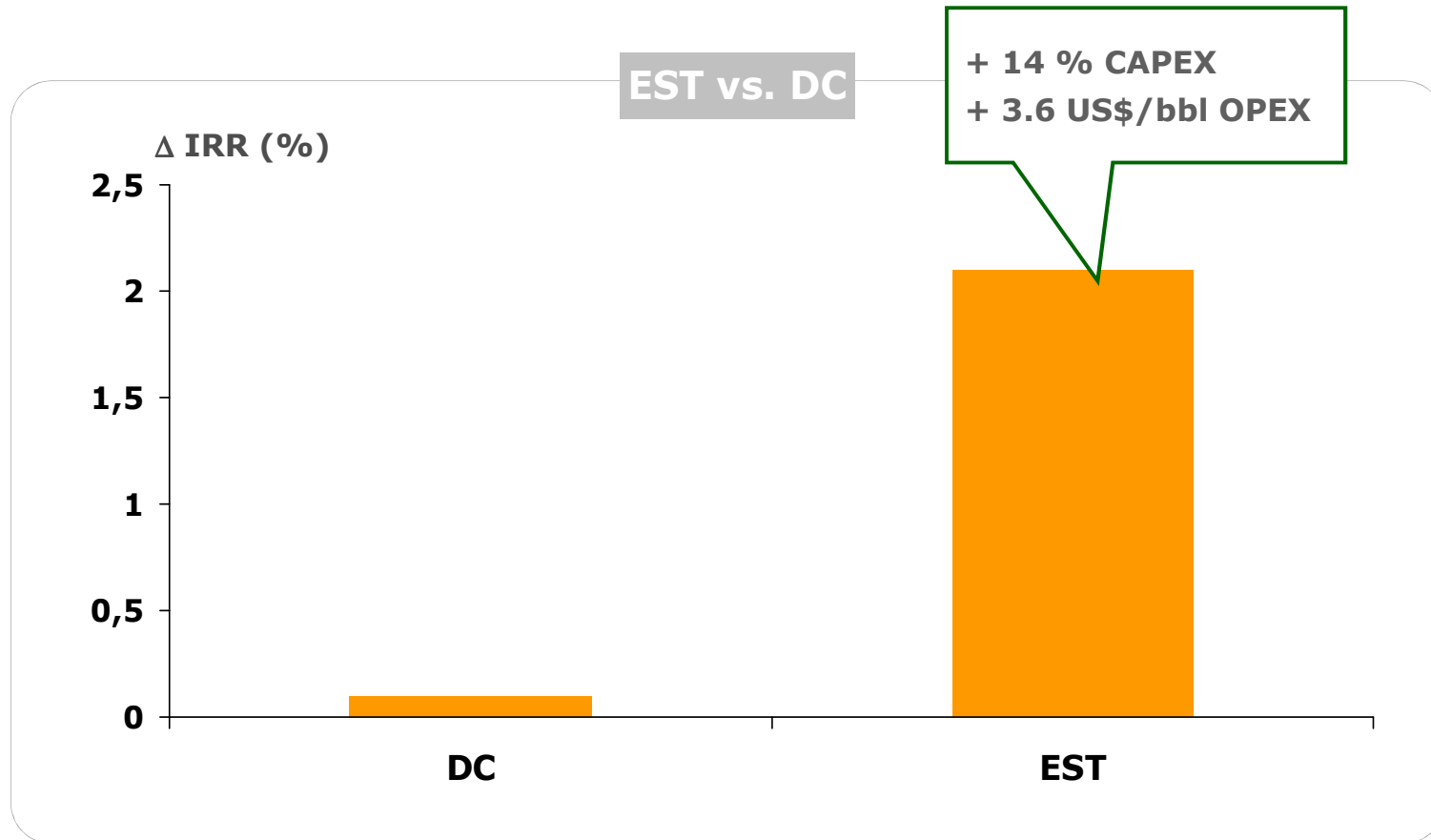


Conceptually, EST allows to transform products/fuels with medium/low commercial value to liquid fuels (mainly Diesel) with high commercial value:

- Gas-to-liquids concept (NG to liquid fuels)
- Zero coke → clean technology



EST vs. DC profitability



(Natural Gas Scenario 3 \$/MBtu)

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Conclusion

- EST (Eni Slurry Technology) is a novel technology to fully convert heavy oils, oil sands bitumens and petroleum residues into distillates
- The EST advantages include:
 - Total feedstock conversion to high quality products (no production of either heavy fuel oil or coke)
 - High product slate and feedstock flexibility
 - High products upgrading
 - Lower environmental impact compared to thermal cracking technologies



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EST Sannazzaro Plant



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