ADVANCED BIOFUELS

OPPORTUNITIES IN THE CENTRAL EUROPEAN REGION

László Keresztury
Head of Refining R&D

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MOL GROUP IS...

▶ AN INTEGRATED, INTERNATIONAL OIL AND GAS COMPANY
▶ HEADQUARTERED IN BUDAPEST, HUNGARY
▶ TRACK RECORD OF OVER 100 YEARS IN THE INDUSTRY
▶ LEAD POSITIONS IN OUR HOME MARKETS WITHIN CENTRAL EASTERN EUROPE

CORE ACTIVITIES

CCS EBITDA CONTRIBUTION OF THE MAIN SEGMENTS IN 2015 (USD MN)

- **UPSTREAM**
  - 719

- **DOWNSTREAM**
  - 1650

- **GAS MIDSTREAM**
  - 214

ALL FINANCIAL DATA FROM 2015
4 refineries and 2 petrochemical plants

- Crude oil into a range of refined products for domestic, industrial and transport use
- The products include, among others, gasoline, diesel, heating oil, aviation fuel, lubricants, bitumen, sulphur and liquefied petroleum gas
- Produce and sell petrochemicals worldwide and hold a leading position in the petrochemical sector in the Central Eastern Europe region
DRIVERS OF ADVANCED BIOFUELS

Renewable energy targets & minimize Indirect Land Use Change.

Hungary:

By 2020:
0.5 e% advanced biofuel - indicative aim (RED)
6% GHG reduction (FQD) & 10 e% renewable share (RED)

MOL opportunities:
to convert waste feedstock to advanced biofuels

GHG-efficient technology alternatives are identified
CHALLENGES

▶ TO REACH 6% GHG DECREASE ON TOP OF 10E% BLENDING BY 2020
▶ BEYOND 2020 IS A MOVING TARGET
▶ PROLIFERATION OF RENEWABLE FUEL REGULATIONS IN EU COUNTRIES
  ▶ Dedicated product distribution chain to different grades (variable bio content)
▶ BLENDING WALL - COMPATIBILITY TO THE AVAILABLE MOBILITY SOLUTIONS
▶ FEEDSTOCK AVAILABILITY CHALLENGE – VOLUME, QUALITY, SEASONALITY
  ▶ Lack of waste cellulose supply chain in the region
  ▶ Non-biodegradable waste is not recognized as GHG decreasing potential
TECHNOLOGY ALTERNATIVES
REFINERY INTEGRATION OF BIO PRODUCTS

Waste oils & fats

Bio coal

Hydro pyrolysis

Bio crude

Torrefaction

Pyrolysis

Bio fuel oil

Cellulose

Gasification

Bio H2

Bio MeOH

FT liquids

Sugar

Fermentation

Bio alcohol

HVO

PRODUCT

FOSSIL

Agricultural residue

Forest residue
MOL IMPLEMENTATION OPPORTUNITIES

UTILIZATION OF EXISTING REFINERY ASSETS

HVO (RENEWABLE DIESEL) UTILIZATION

▶ SUCCESSFUL BLENDING TESTS COMPLETED
▶ ADEQUATE PRODUCT QUALITY
  ▶ Decreased cold flow additive response
▶ PRODUCT QUALIFICATION*

CO-PROCESSING OF WASTE FATS IN HYDROTREATER

▶ RAW MATERIAL PRETREATMENT
  ▶ To eliminate catalyst poisons
▶ SUCCESSFUL REFINERY TEST-RUNS IN GASOIL HYDROTREATER
▶ PRODUCT QUALIFICATION*

CO-PROCESSING OF PYROLYSIS OIL IN FCC

▶ CONCEPT PHASE
▶ BIOMASS PRETREATMENT TO MINIMIZE METAL CONTAMINATION
▶ PYROLYSIS PRODUCT ARE AVAILABLE ON THE MARKET
  ▶ High oxygen content
  ▶ Significant water content
▶ PRODUCT QUALIFICATION*

*Status quo - A number of national legislations require renewable traceability in the product by analytical method

MASS BALANCING WOULD PROVIDE ENHANCED FLEXIBILITY AND QUICKER IMPLEMENTATION
THANKS YOU FOR YOUR ATTENTION!