Repsol Chemicals Control Tower E2E Supply Chain Optimization

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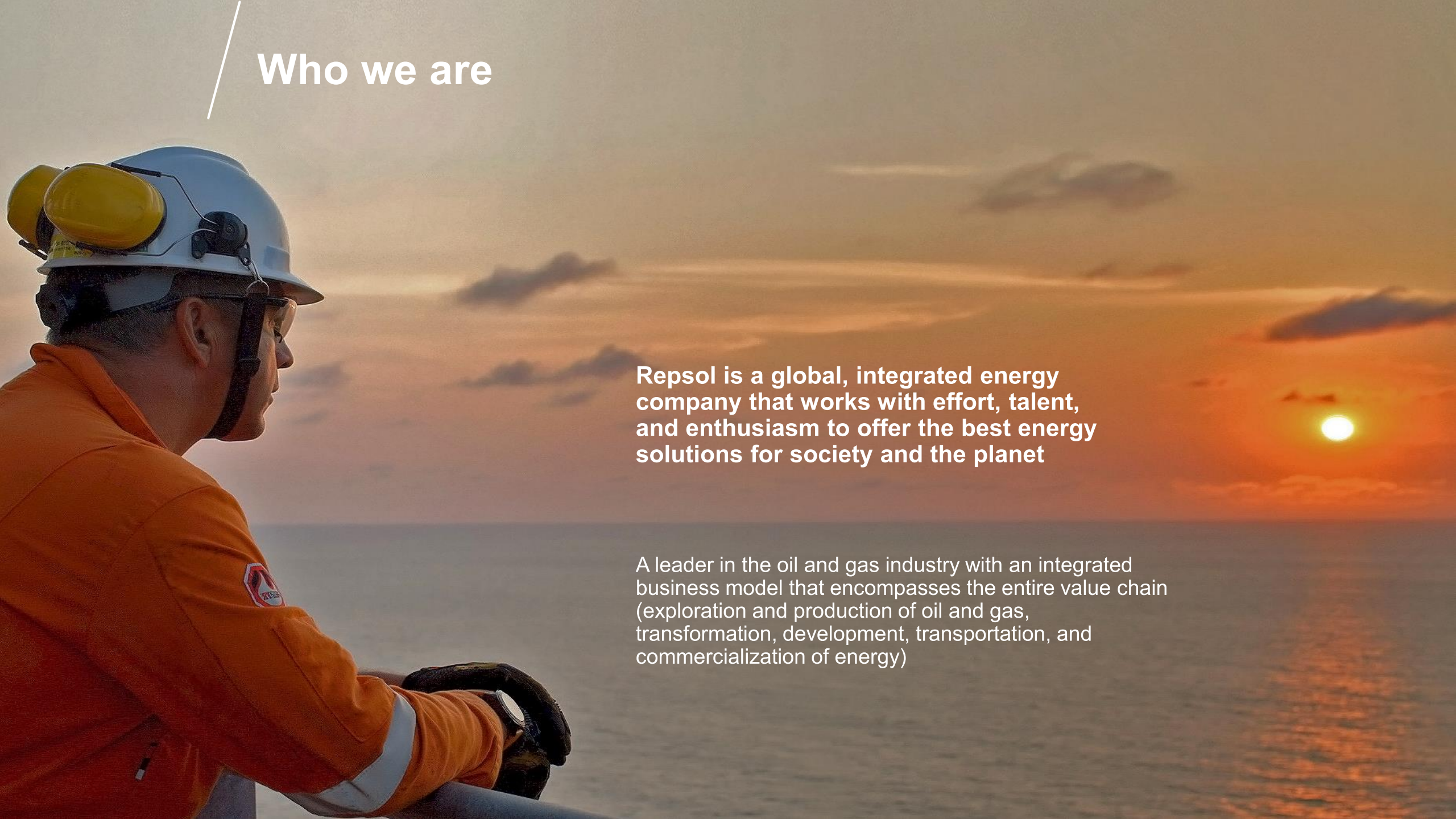
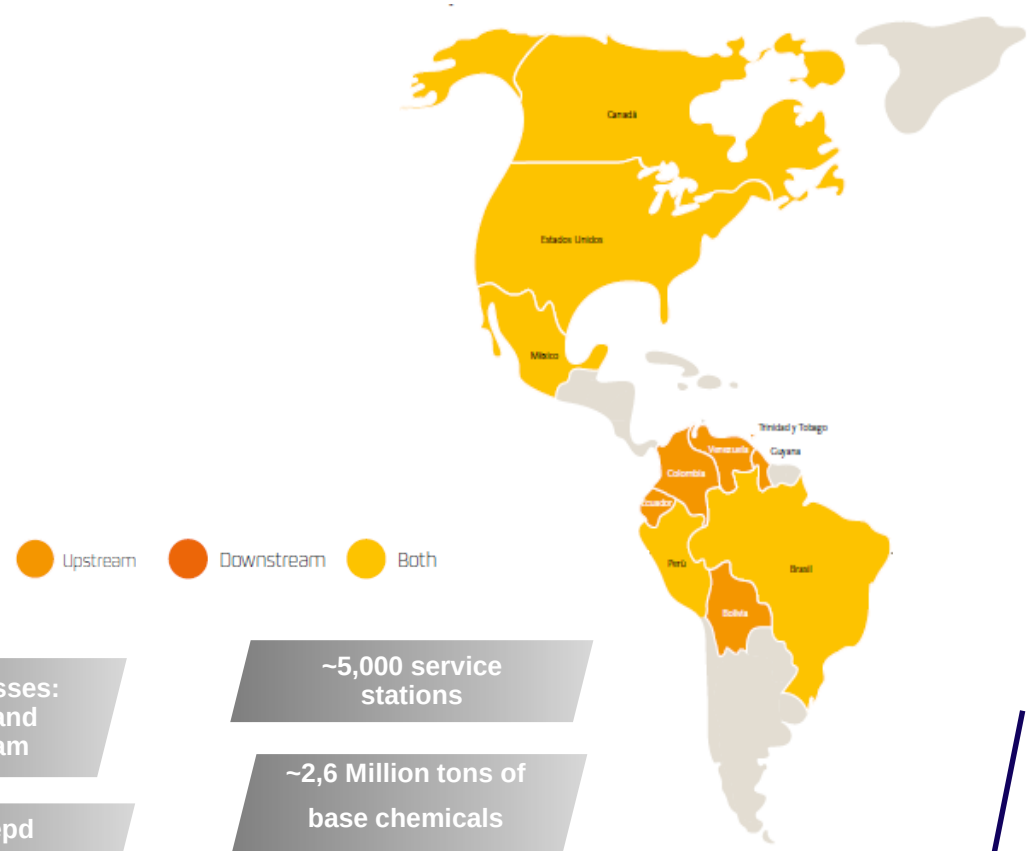
Who we are



Repsol is a global, integrated energy company that works with effort, talent, and enthusiasm to offer the best energy solutions for society and the planet

A leader in the oil and gas industry with an integrated business model that encompasses the entire value chain (exploration and production of oil and gas, transformation, development, transportation, and commercialization of energy)

Our global presence



Upstream Downstream Both

Core businesses: Upstream and Downstream

~700 kboepd production

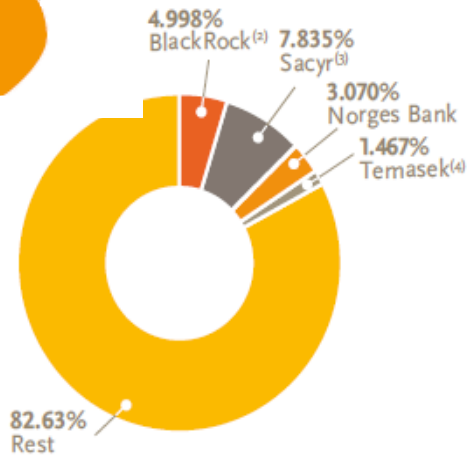
~2,140 billion boe proved reserves (*)

~5,000 service stations

~2,6 Million tons of base chemicals capacity (**)

~1 Million bpd refining capacity

Our shareholders (*)



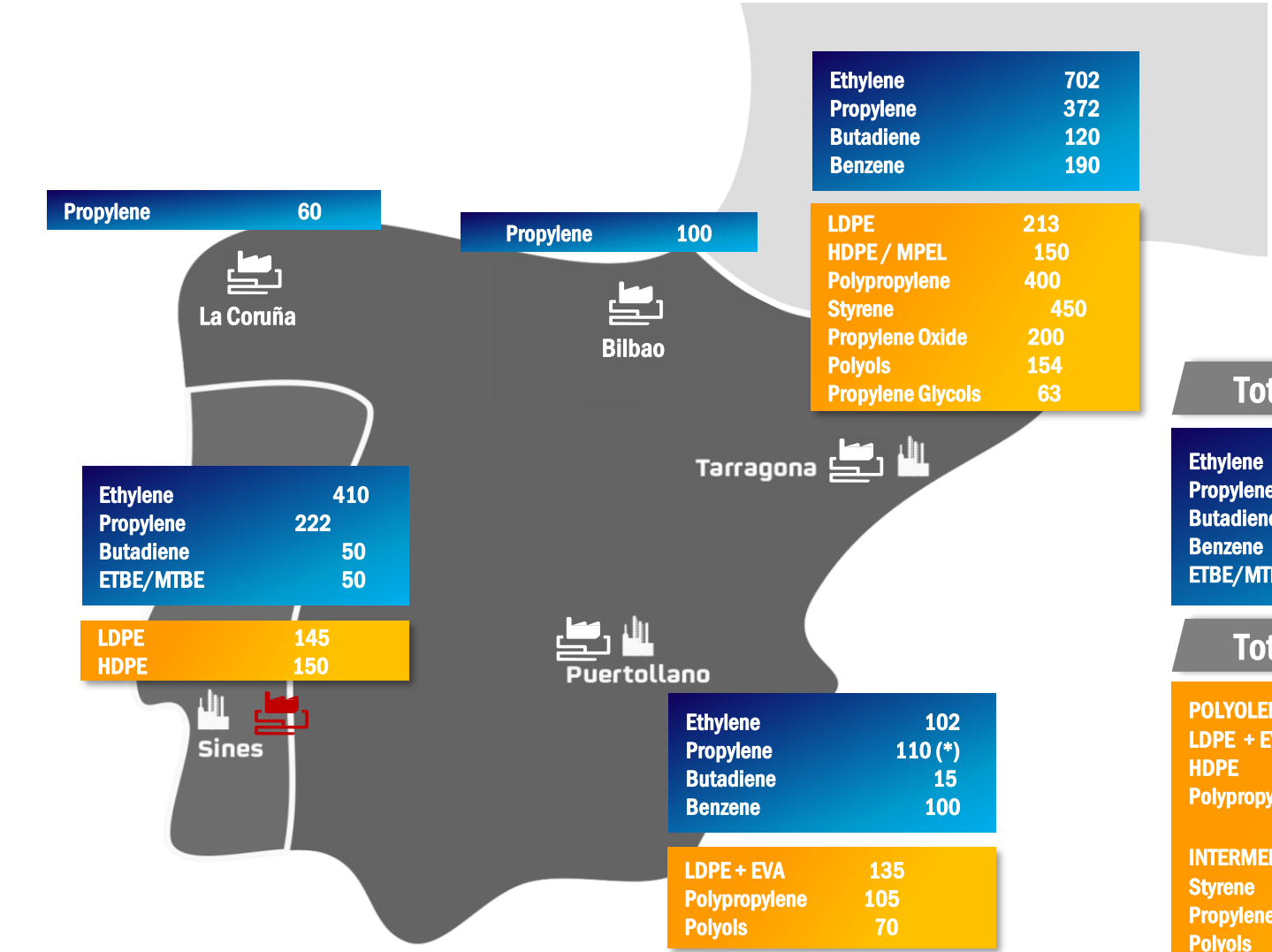
(*) As of 31/12/2019 (**) Includes 1.2 Million tons of Ethylene and 1.4 Million tons of other base Chemicals
Note: boepd = barrels of oil equivalent per day

Our chemical business

Our chemical division **produces and markets a wide variety of products**, ranging from basic petrochemicals (ethylene, propylene, benzene, butadiene) to derivatives (polyethylene, polypropylene, styrene, polyols and glycols). This division benefits from a **high degree of integration** between basic and derivative chemicals as well as with the group's refining division.

Our products are used to manufacture **everyday articles** which improve people's quality of life, wellbeing and safety.

Our key locations: base and derivative chemical sites in Iberia



(*) FCC Propylene capacity included

Total	2.443
Ethylene	1.214
Propylene	704
Butadiene	185
Benzene	290
ETBE/MTBE	50

Total	2.235
POLYOLEFINS	1.298
LDPE + EVA	493
HDPE	300
Polypropylene	505
INTERMEDIATES	937
Styrene	450
Propylene Oxide	200
Polyols	224
Propylene Glycols	63

kt/y 31-12-2018

Our chemical products

Base Chemicals

- Ethylene
- Propylene
- Butadiene
- Benzene
- Pygas
- ETBE/MTBE

Intermediates

- Propylene Oxide
- Styrene
- Polyols
- Glycols

Polyolefins

- High Density Polyethylene
- Low Density Polyethylene
- Linear Low Density Metallocene
- Polypropylene
- EVA/EBA

A VUCA Environment

REPSOL Objectives

- Execute in today's challenging business context
- Look at the business across the entire value chain
  … that is:
  - Across all of Repsol's chemical business
  - Across all players in the supply chain (Repsol plants and customers)
- Visibility to changes in demand
- Flexibility to make changes based on data (multiple times per week)

Control Tower Vision

Create a best in class end to end Control Tower solution for the Repsol Chemicals business using state of the art optimization and forecasting techniques.

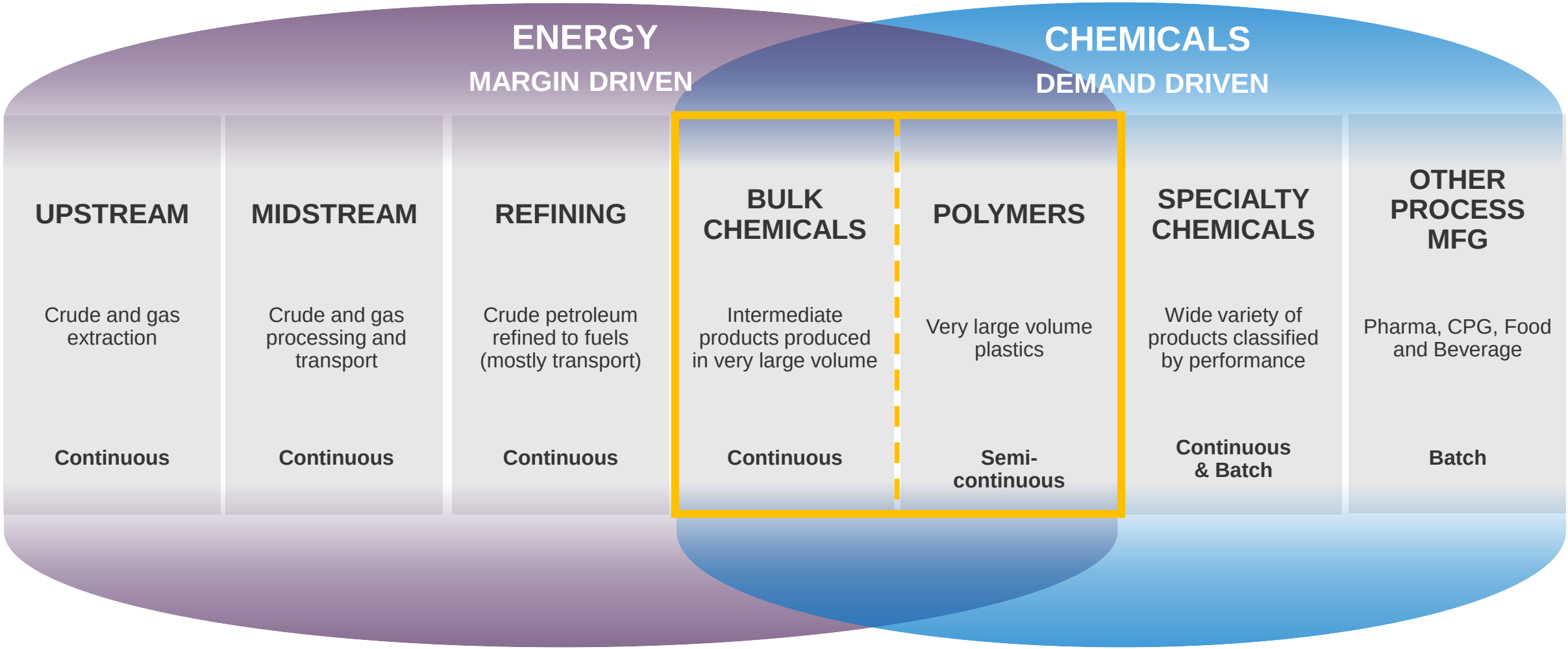
Provide full economic and customer service driven trade off planning for the full Repsol upstream and downstream chemical business.

Have the ability to execute realistic production schedules based on those plans.

Seamlessly integrate best in class planning and scheduling.

Support Repsol’s digital program in the journey to the smart enterprise.

Oil and Chemicals Value Chain



Supply Chain Differences Across the Value Chain

Refining | Olefins | Aromatics

Margin Driven Process

- Major Operation Challenges
  - Optimize feedstock selection and operating conditions
  - Accurately model varying yields and other non-linear process relations
  - Provide visibility from inbound logistics, through process operations to outbound product
  - Feedback from daily data reconciliation to planning process
  - Large variation in feedstock but few simple products

Derivatives | Polymers

Demand Driven Process

- Major Operation Challenges
  - Accurately modeling complex production wheel operation across growing product slate
  - Profitably balancing interactions among orders, production, inventory and distribution
  - Optimizing production slate and asset utilization to profitably match market demands
  - Simple feedstock but large number of different products

Responsiveness to Today's Market

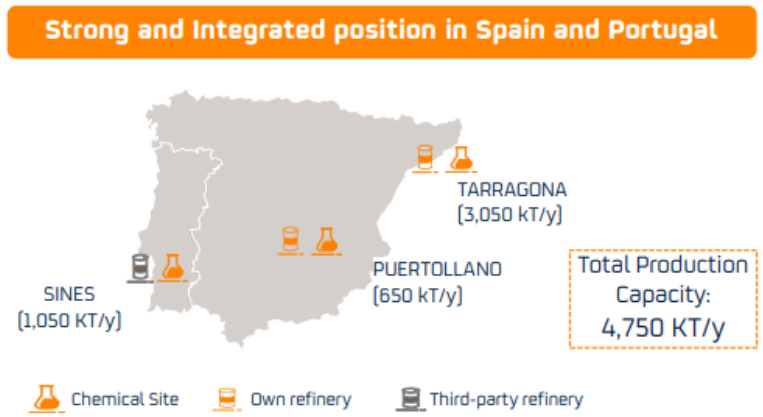
Respond quickly to changes in demand:

- Deliver most effectively and profitably when in unconstrained supply
- Customer-centric prioritization of delivery when in constrained supply
- Respond effectively when demand changes rapidly up or down
- Balance supply and demand when major economic units need to shut down

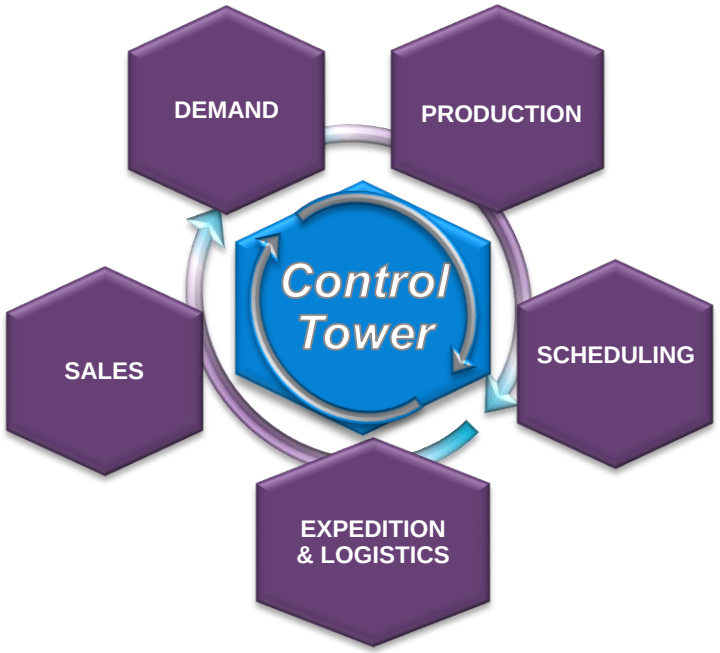
Project Goals

Achieve the following benefits:

- Support REPSOL's strategy of differentiated position in chemicals
- Improve Delivered Service to Customers and achieve customer service improvement of **2-5%** over "before" benchmarking
- Maximizing margin from end to end optimization
- Produce and distribute chemicals in the most efficient and cost effective way

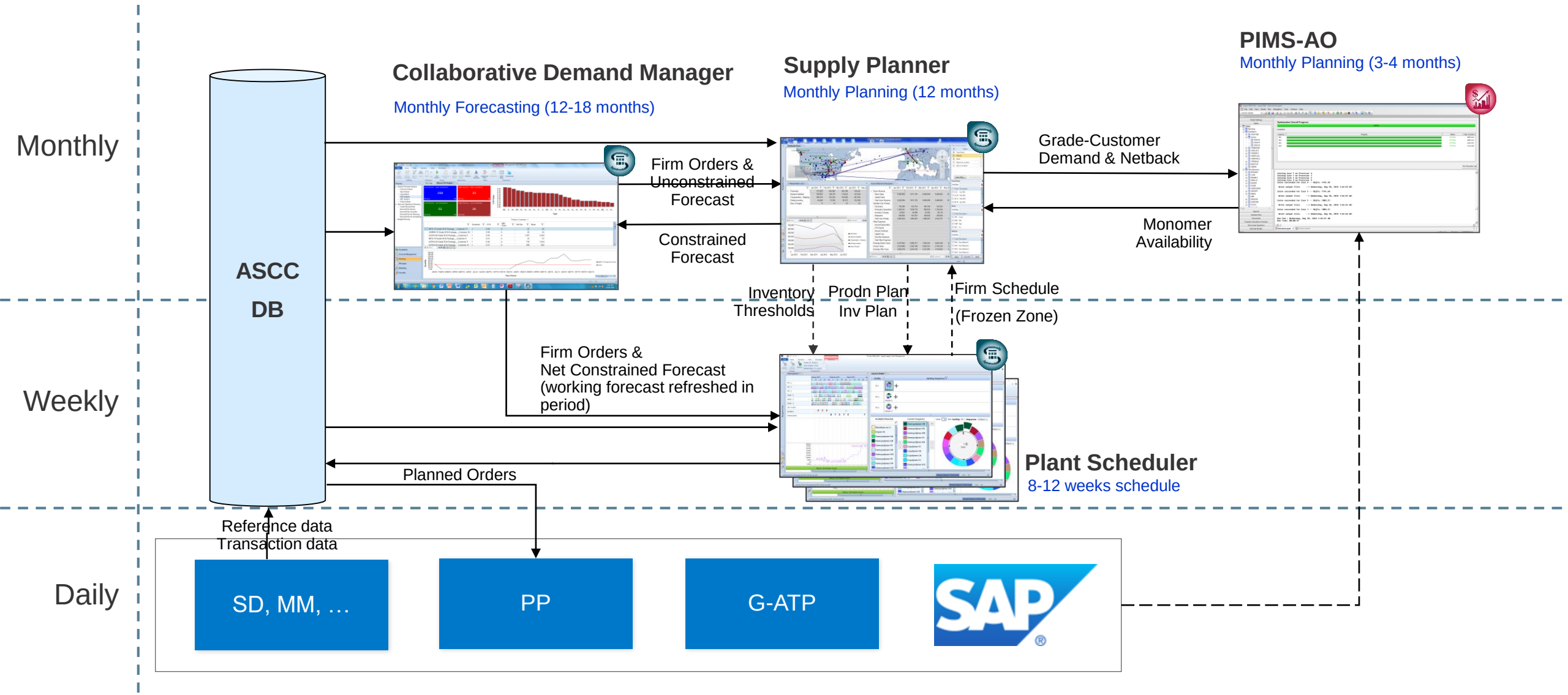


Control Tower - Overview



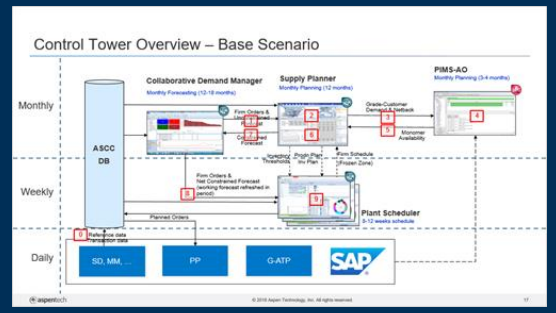
Control Tower - End-to-End Value Chain Optimization

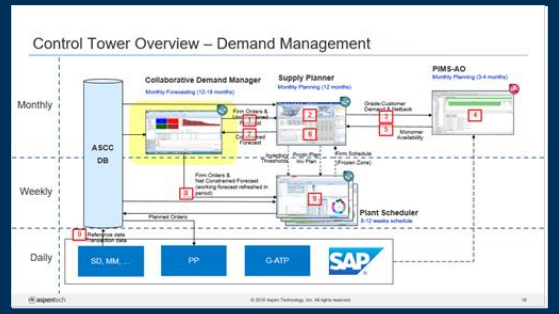
Workflow

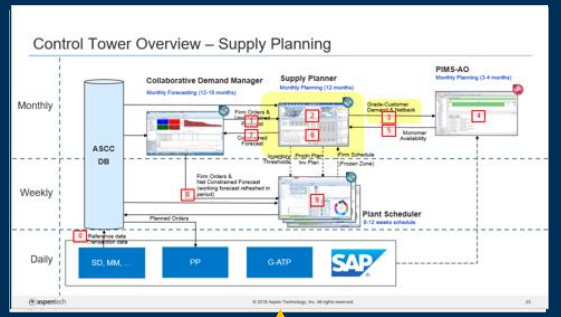


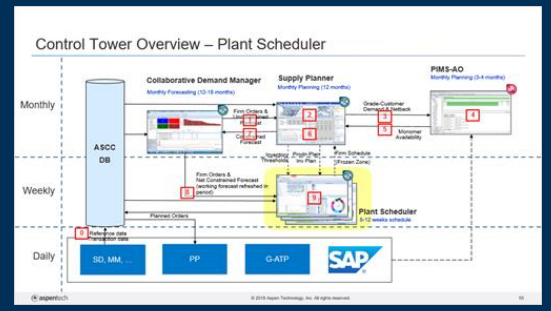
Control Tower – End-to-End Optimization & Forecasting

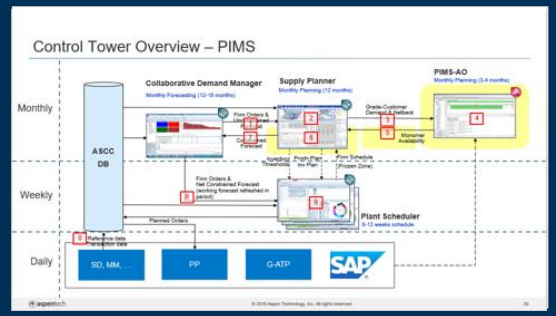
Reporting Dashboard Brings Together Results from all Applications

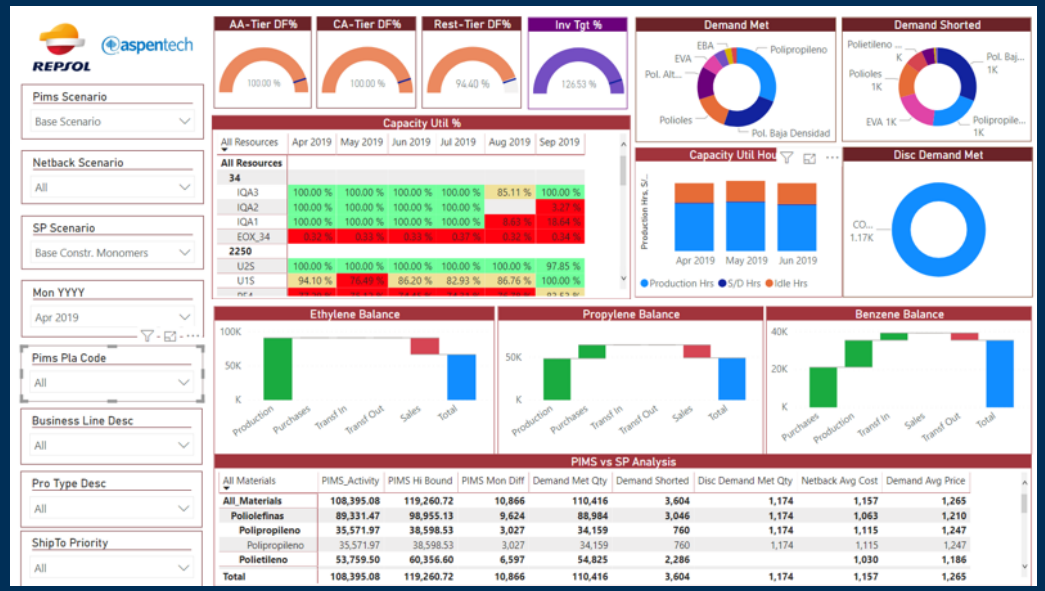


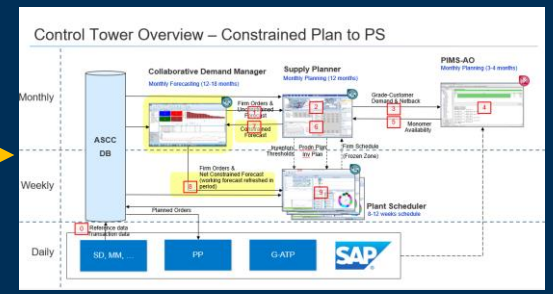












Value Chain Visibility

Control Tower Dashboard to Report KPIs across Multiple Scenarios

Demand Fulfillment Data by Cust Tier from PS / SP

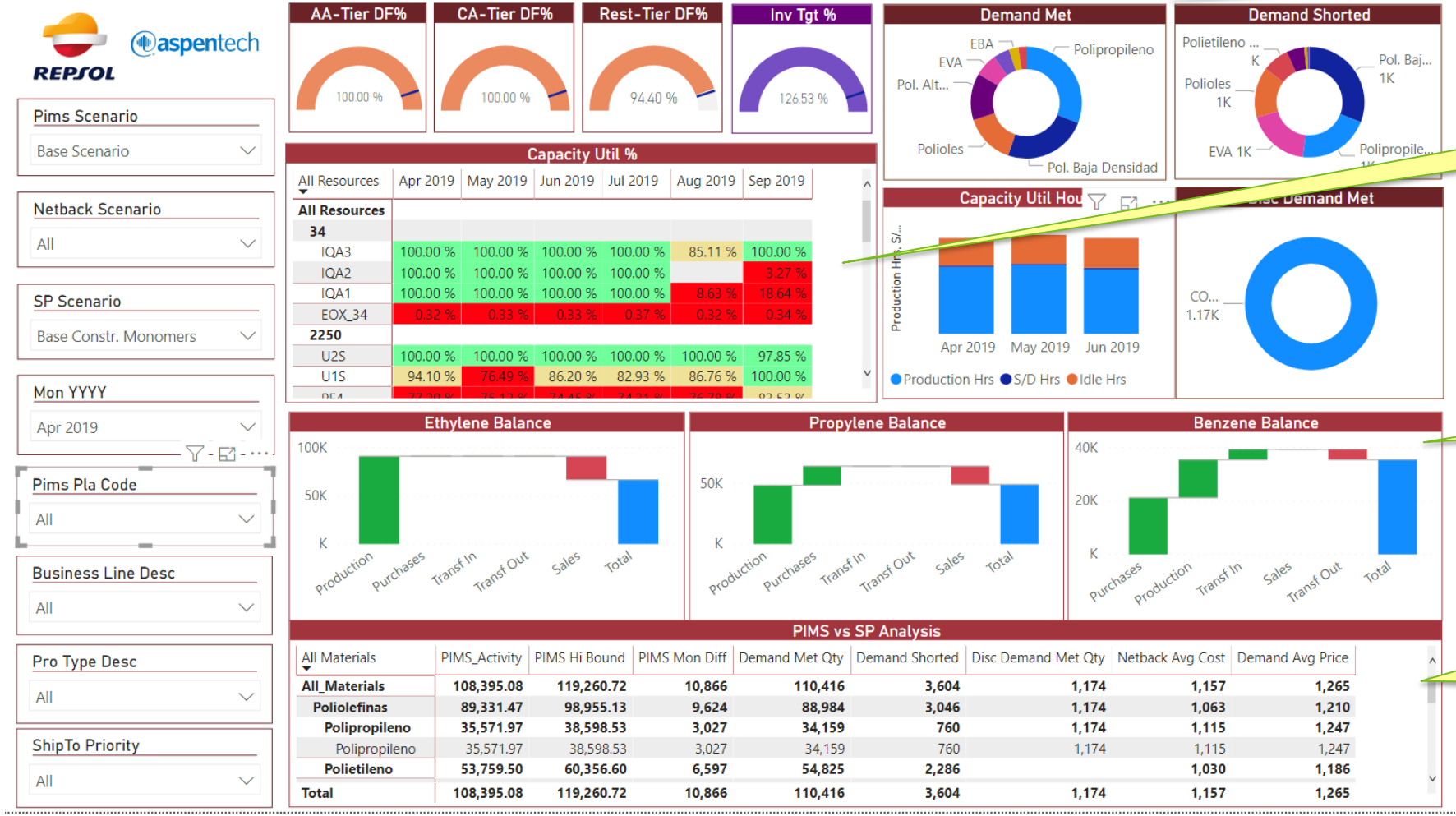
Demand Data from CDM / SP

Repsol key corporate and business unit KPIs on configured dashboard

Derivative Unit Capacity Data from SP / PS

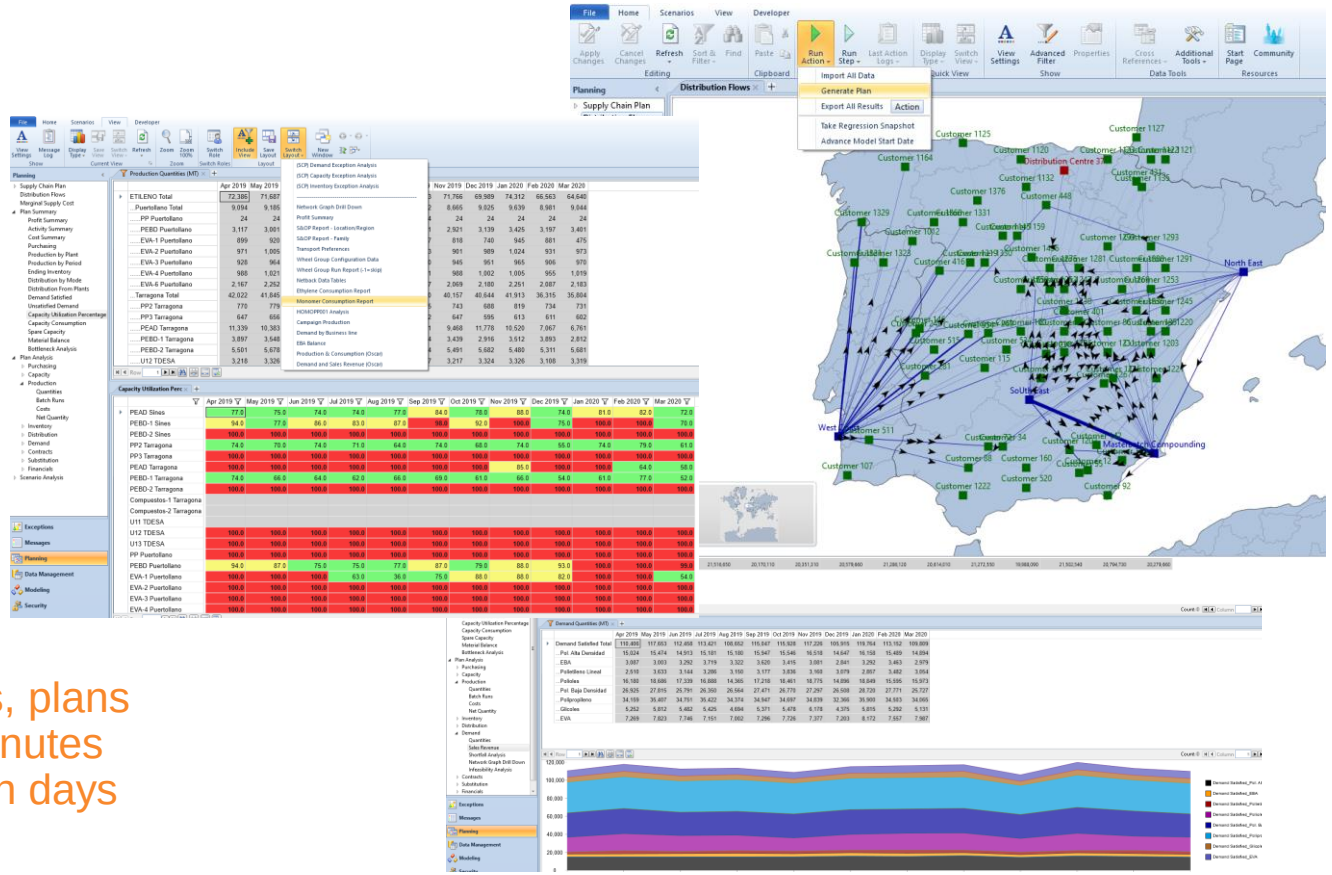
Monomer Balance Data from PIMS

Netbacks and Monomer/Polymer Balance from PIMS/SP



Agility, accessibility, transparency

Create Scenarios to analyse multiple options



Make decisions based on marginal economics across the supply network

Regenerate forecasts, plans and schedules in minutes and hours rather than days

Spend more time on business decisions and less time on data manipulation

REPSOL chemicals benefits findings

1. ***Improving Delivered Service to Customers***
   - Current actual (target) customer service - Intermediates 87% (90%) Polyolefins 77% (85%)
   - Improvements in customer service of **2-5%** from MVP prototype
   - There will be further improvements from demand prioritisation (client priorization) and supply optimization across all plants
   - Plant Scheduler – sequencing considering on-time delivery reduces runouts
   - Supply Planner – demand sizing for capacity feasibility helps avoid runouts
   - Demand Management – better and dynamics forecasting gives better alignment with the plan

2. ***Maximizing margin from end to end optimization***
   - Further benefits obtainable from optimizing margin when there are discretionary demand (spot opportunities, export markets, non regular clients…), assume between 5 -10% of additional possible demand, margin difference €5-10 per tonne.
   - Increased prime product through reduction of transition time, minimising transitions and second qualities.
   - Improved cracking decisions: feedstocks, operating conditions, furnaces usage….

3. ***Producing and distributing chemical products in the most efficient and cost effective way.***
   - Optimized Inventory levels – cost reduction.
   - Distribution cost: assuming 12-15% has distribution alternatives with 7-10% difference in cost.


Thank You!