

Grain Ethanol Manufacturers Association

2nd Technical Summit

Topic : Energy Integration and Process Efficiencies

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Industry Expectation to Maximize Profitability



Industry Challenges

Rising Energy Cost

Rising Feedstock Cost

Water Scarcity

Capacity expansion

Multi Feedstock Operation

Round the year consistent operation

Revenue from Co-products

Increase revenue

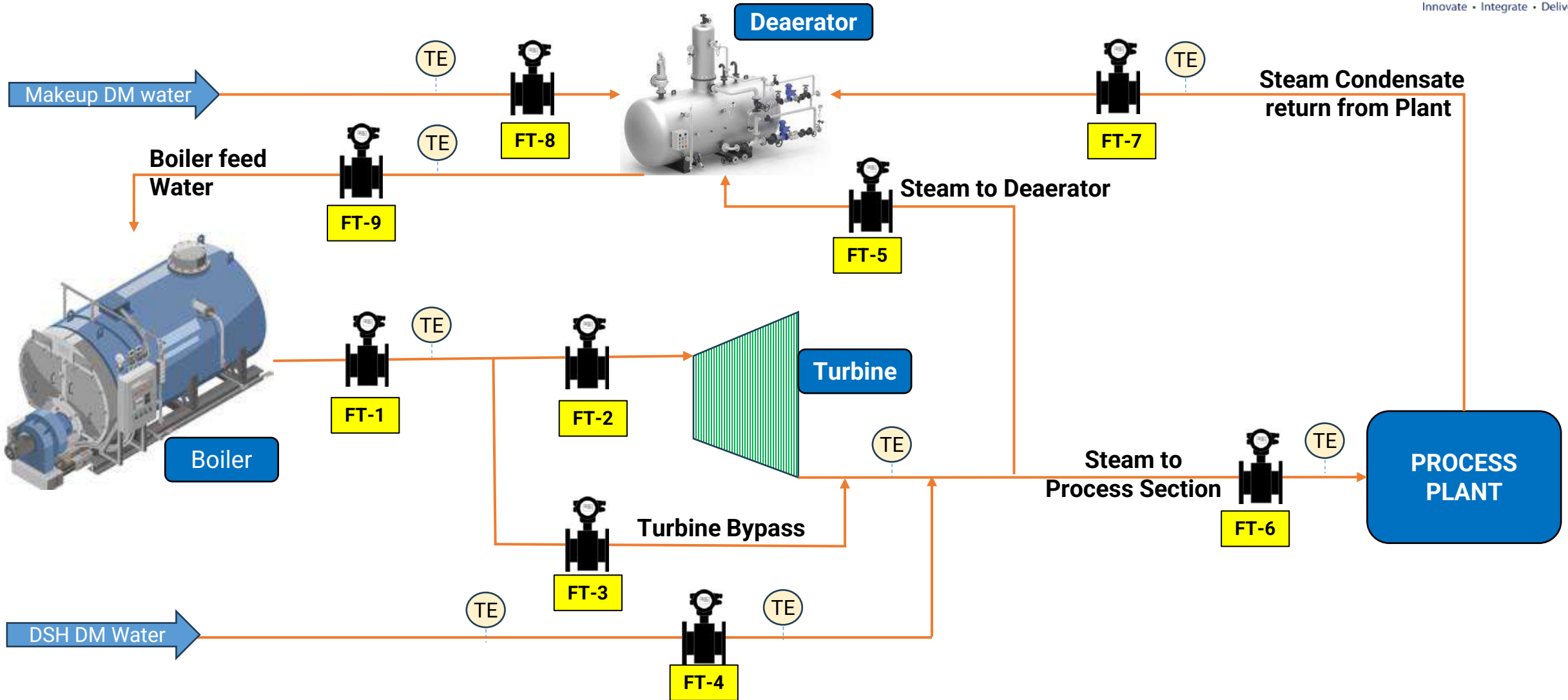
Reduce cost of production

Energy & Water reduction

Increased Process Efficiency

Reduce & Recycle Waste Streams

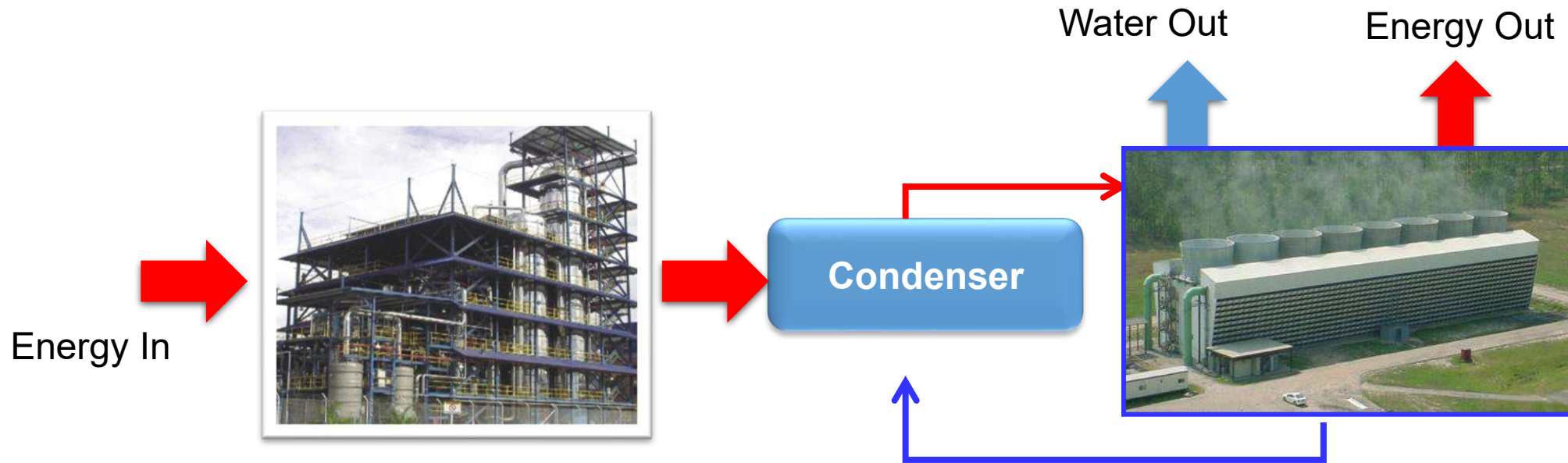
Importance of Steam Measurement For Energy Efficiency



Optimization of Steam Consumption

1. Accurate measurement of Steam at every consumption point
2. Energy recovery by balancing the HOT Streams and COLD Streams within the Ethanol plant.
3. Plugging all Energy losses within the plant by conducting RCA in case of shift from set parameter.

Add-on benefit of Steam saving



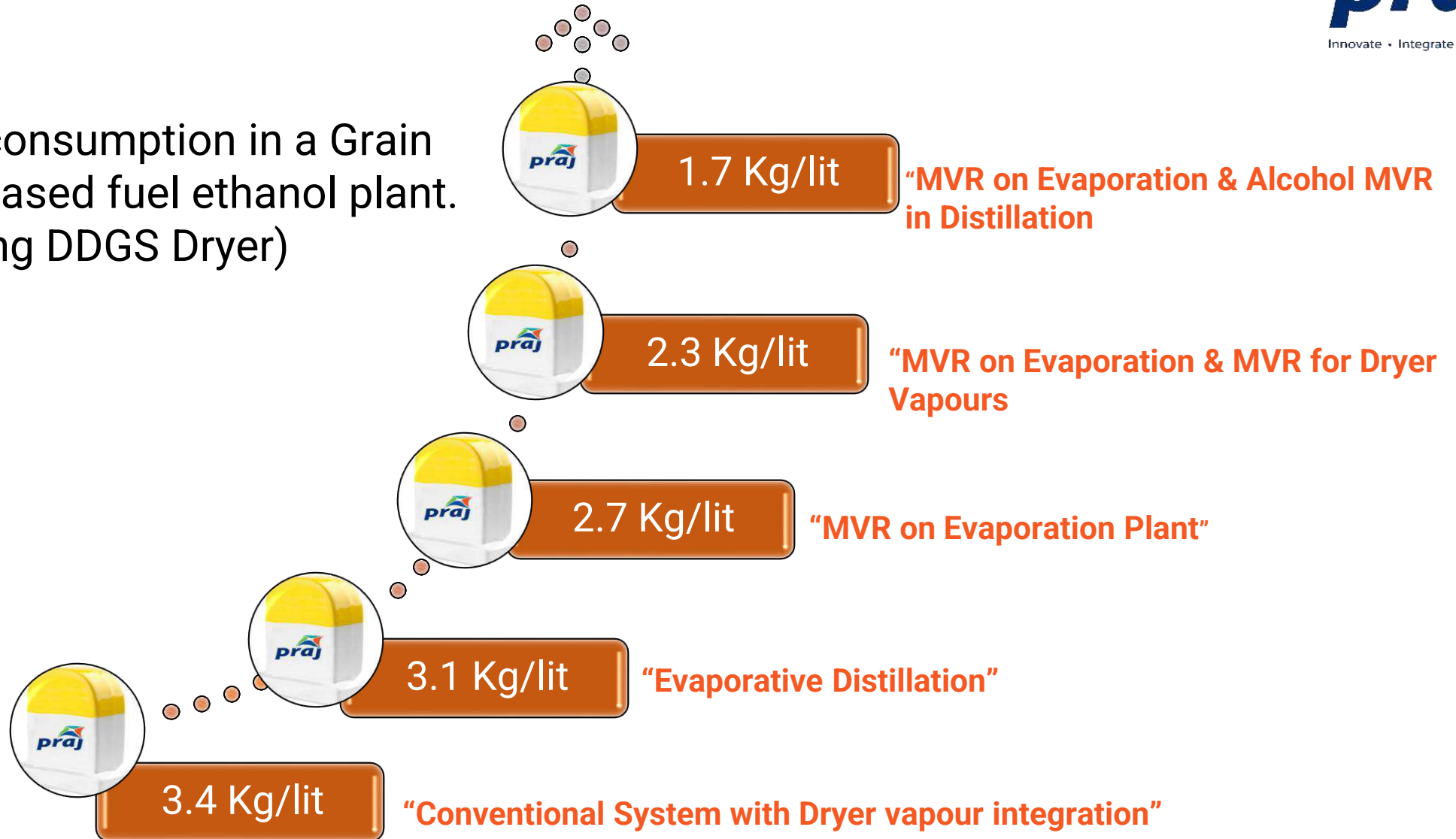
Steam Saving



Water Saving

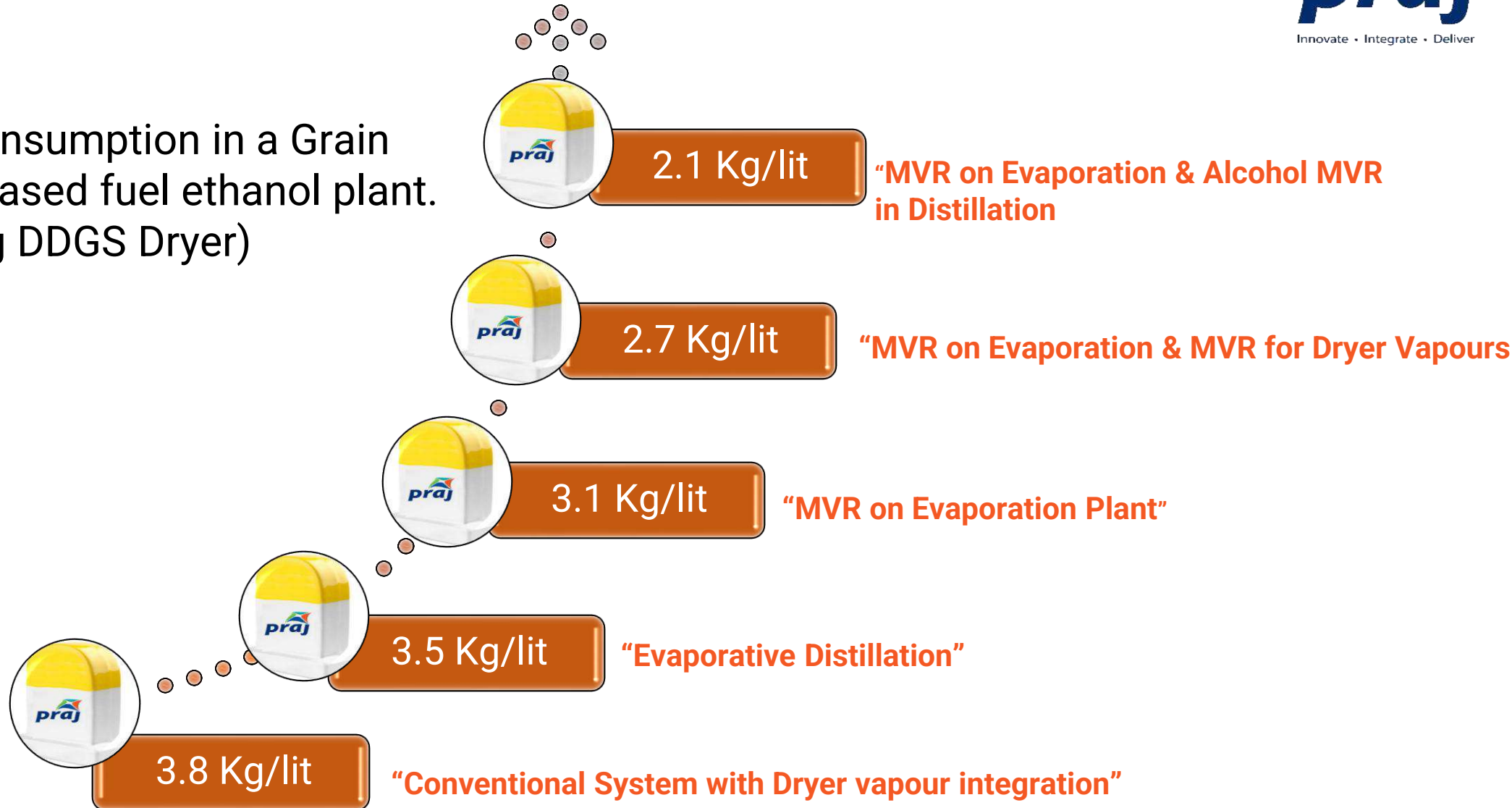
Continuous Endeavor to Reduce Steam Consumption

Steam consumption in a Grain (RICE) based fuel ethanol plant. (including DDGS Dryer)

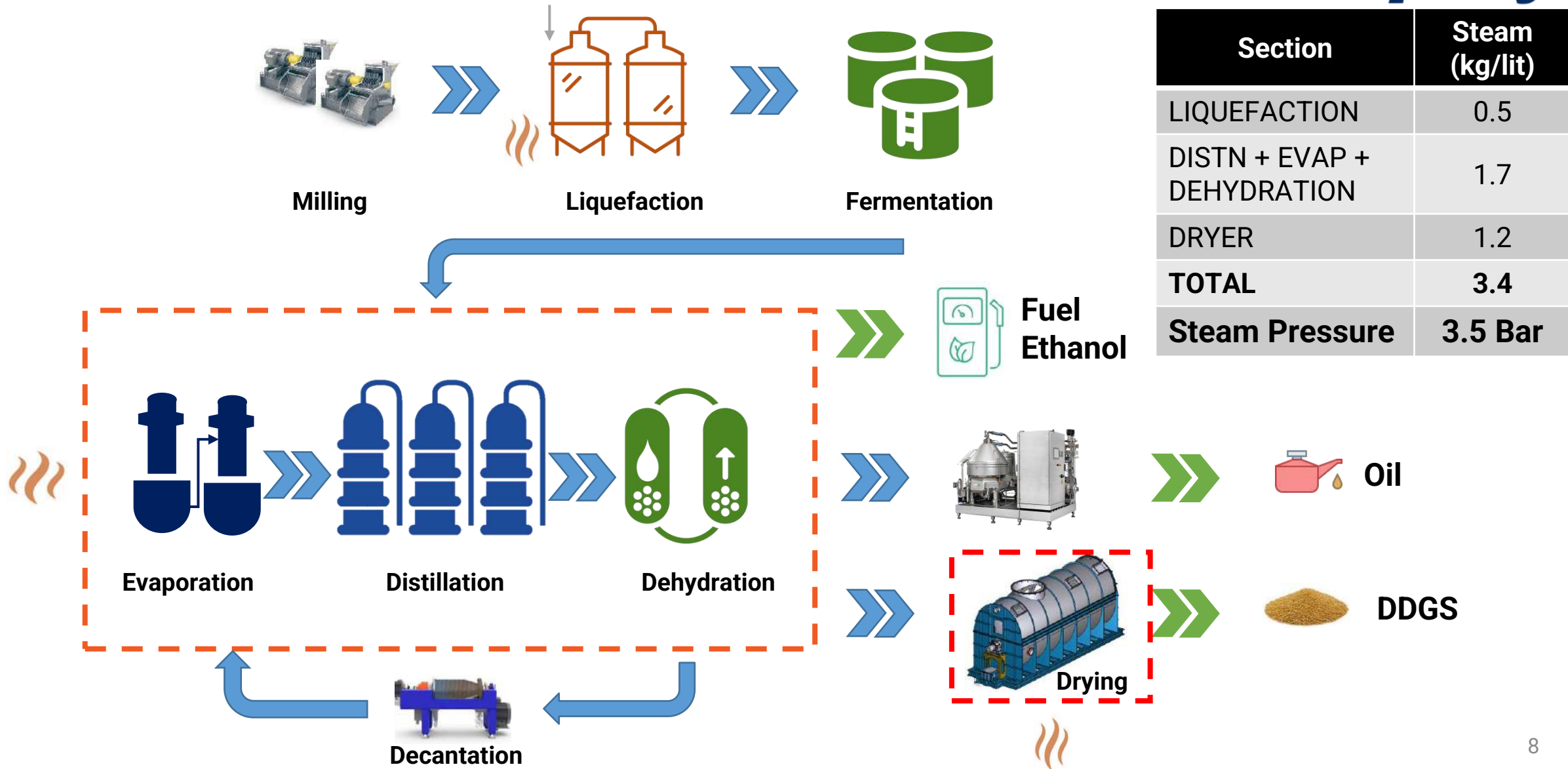


Continuous Endeavor to Reduce Steam Consumption

Steam consumption in a Grain (CORN) based fuel ethanol plant. (including DDGS Dryer)

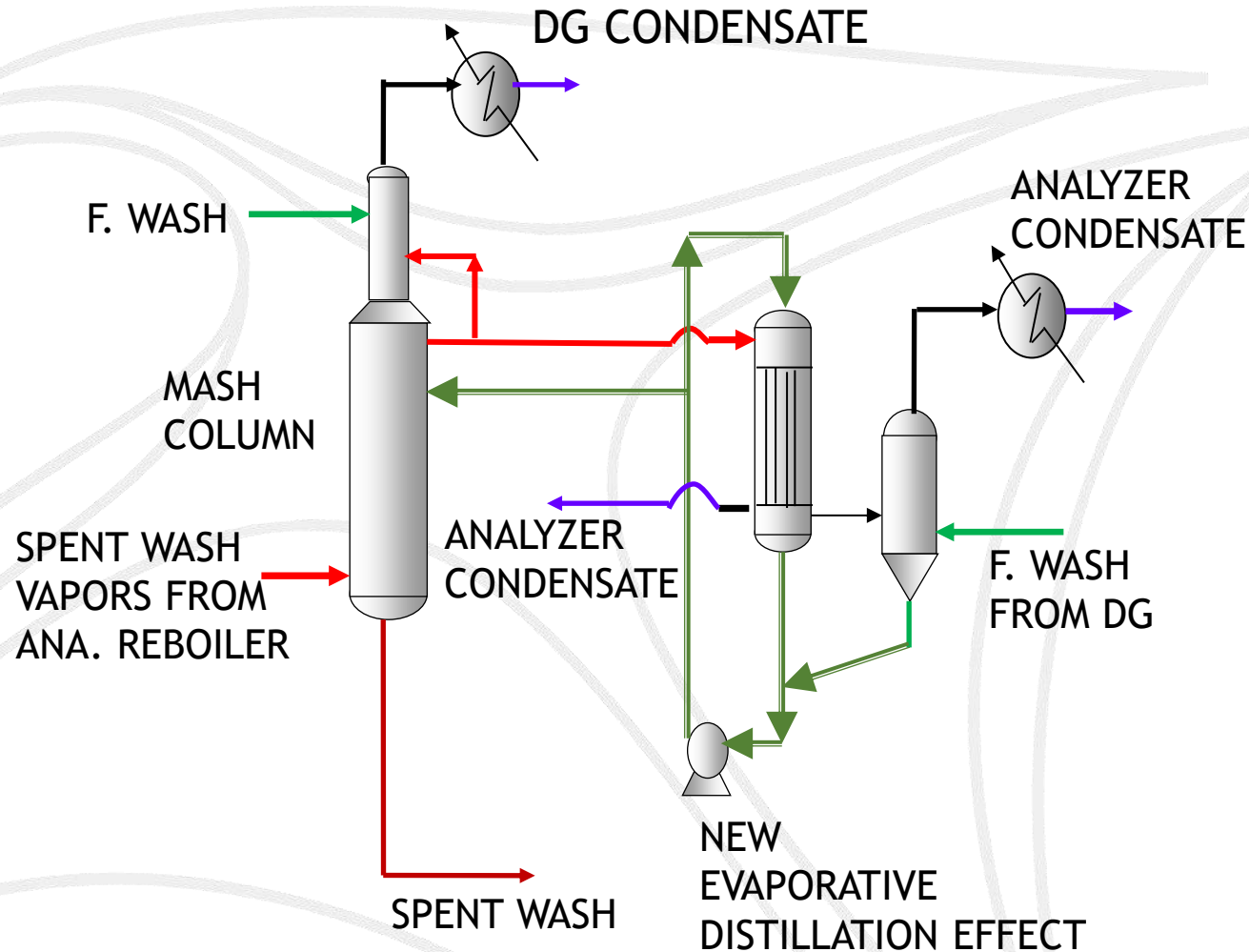


Conventional Dry Grind Grain Ethanol plant



| Section | Steam (kg/lit) |
|----------------------------|----------------|
| LIQUEFACTION | 0.5 |
| DISTN + EVAP + DEHYDRATION | 1.7 |
| DRYER | 1.2 |
| TOTAL | 3.4 |
| Steam Pressure | 3.5 Bar |

Concept of Evaporative Distillation Technology



Energy Reduction

- Lower energy for Beer Stripping by 30%

Capacity Expansion

- Increases Plant Capacity by 30%

Effluent Reduction

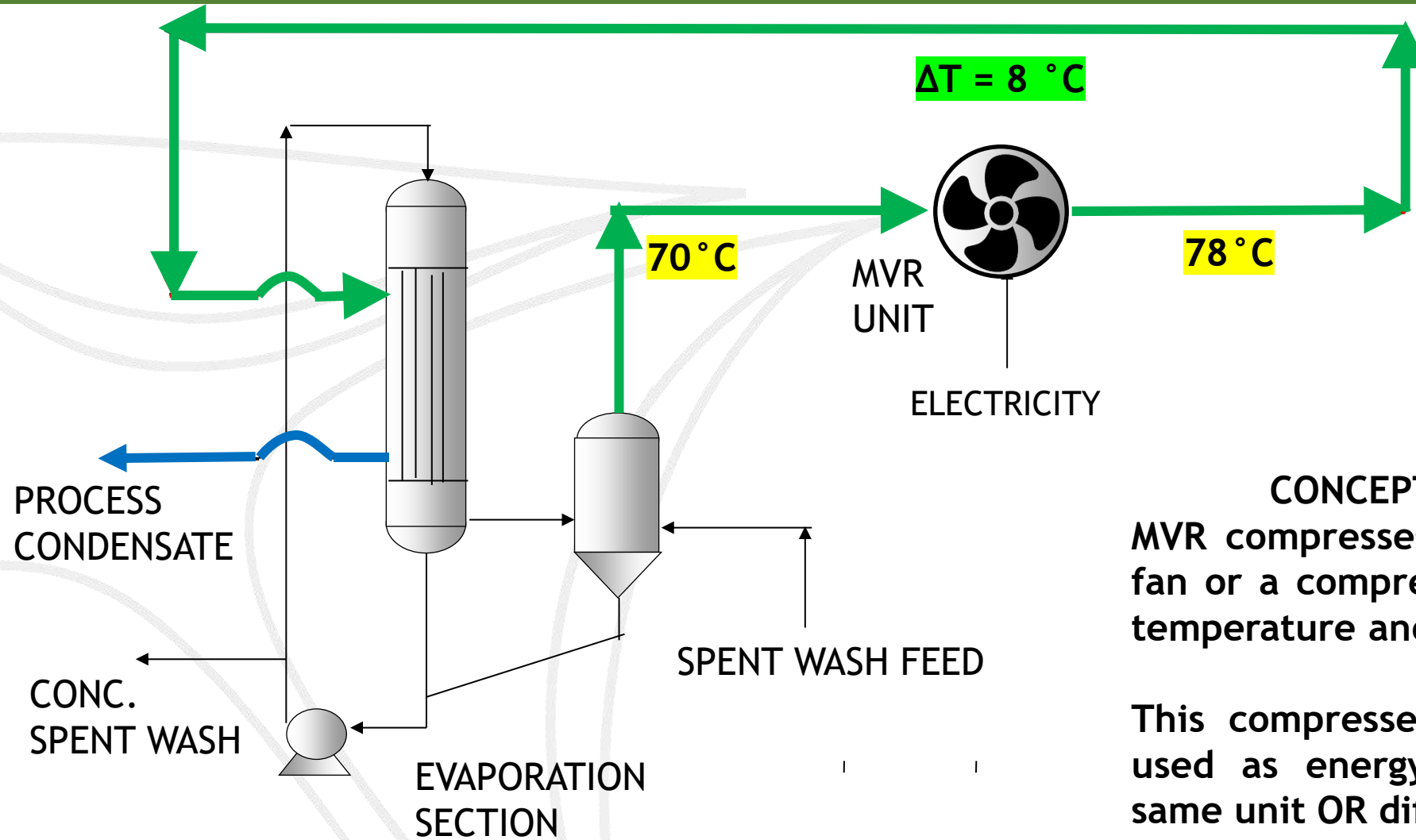
- Lower Spent Wash Volume

Max. Utilization of Existing hardware

- Minimum ADD-ON hardware

PRAJ PROCESS PATENT

Concept of MVR on Evaporation

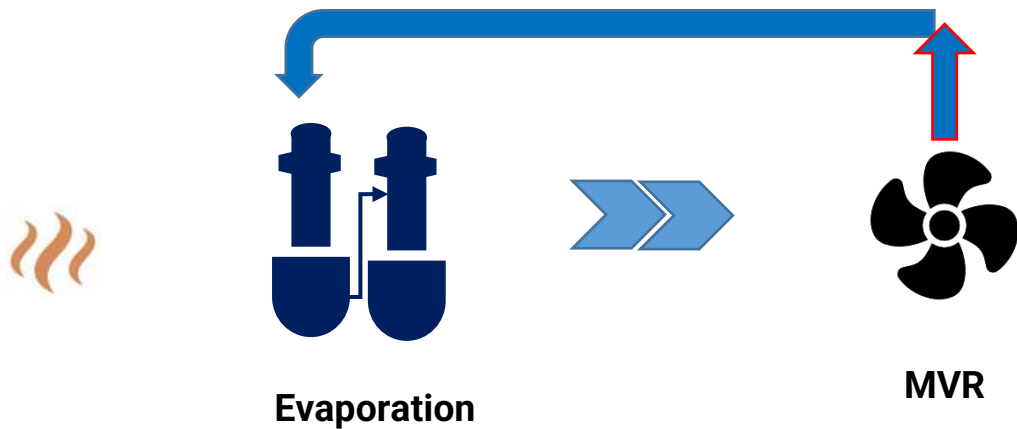
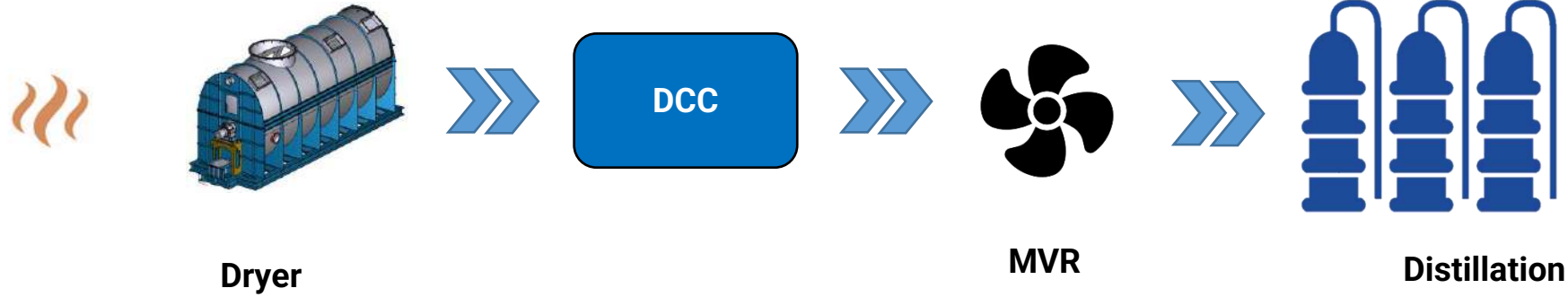


CONCEPT OF MVR

MVR compresses the vapor in a fan or a compressor to a higher temperature and pressure.

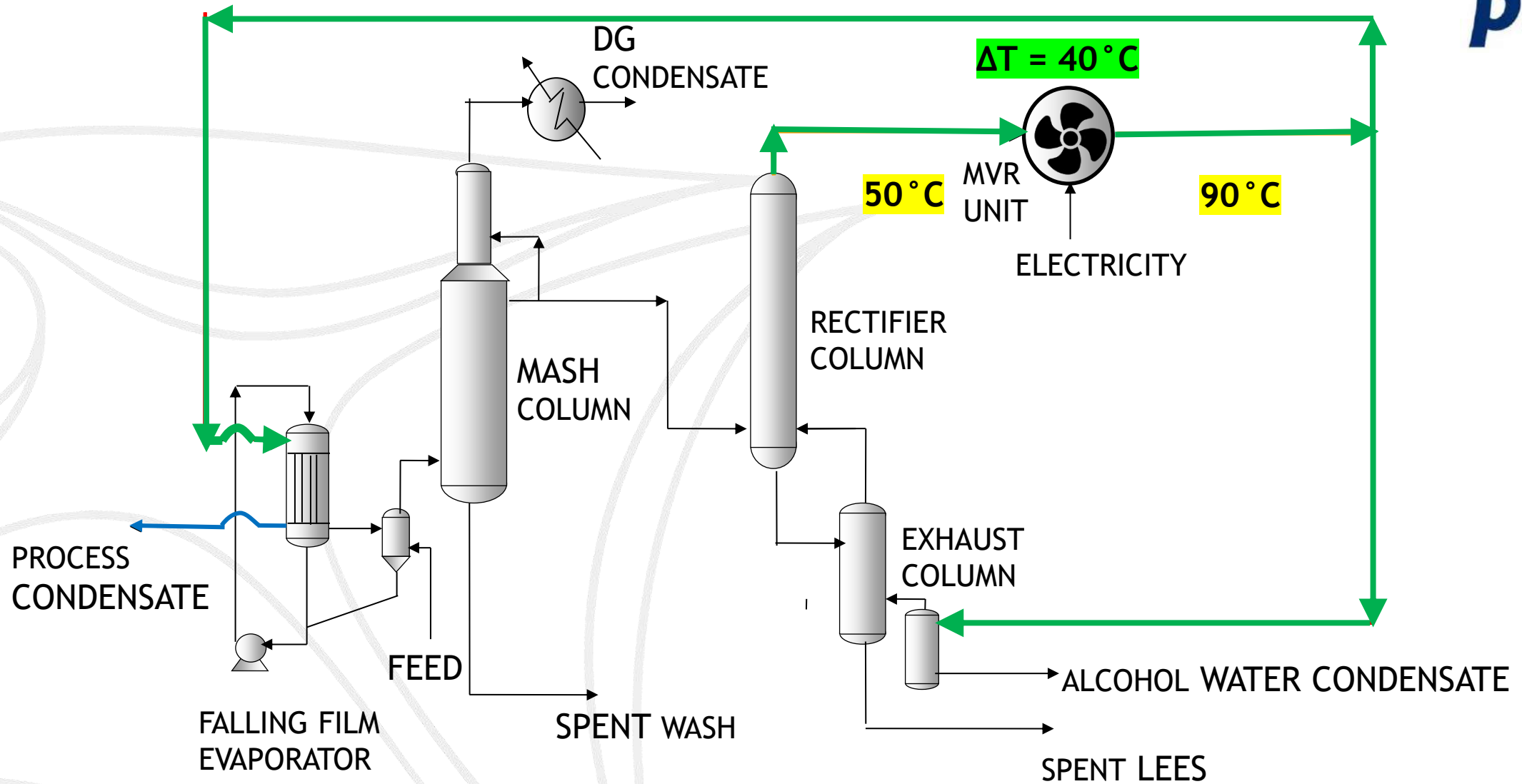
This compressed vapor is then used as energy source in the same unit OR different unit.

Concept of MVR on Evaporation and MVR on Dryer Vapours



PRAJ PROCESS PATENT

Concept of MVR on Distillation



Steam reduction by increasing Ethanol Concentration in Wash



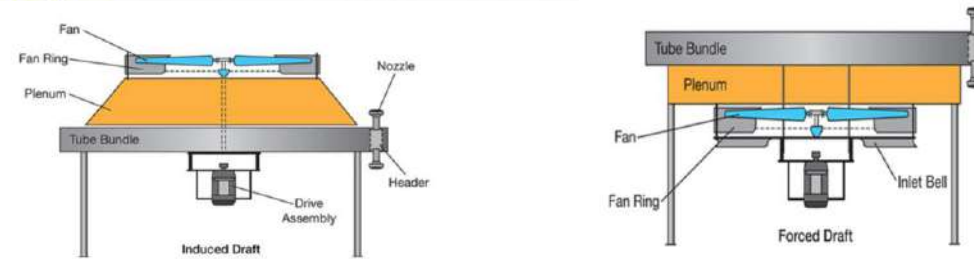
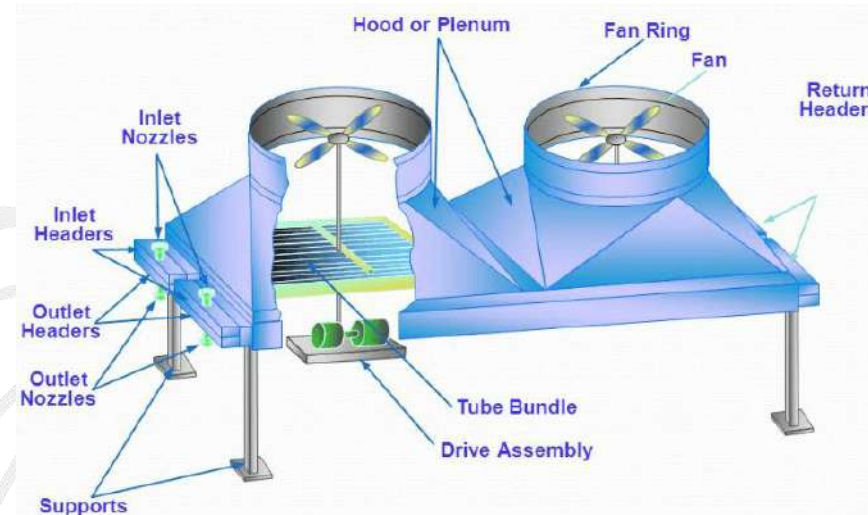
| Sr. No. | Alcohol % in Fermented Wash (For Rice Case) | Complete Process steam requirement (Conventional plant) Kg/Lit of AA |
|---------|--|--|
| 1 | 12% | 3.5-3.7 |
| 2 | 14% | 3.2-3.4 |
| 3 | 16% | 2.7-2.9 |

Water saving by Air Cooled Heat Exchanger (ACHE)

WORKING PRINCIPLE:

An ACHE rejects heat from fluid directly to ambient air. The process fluid passes through the tubes and air stream is passed over the tubes to carry away the heat by convection. The air stream is created by the Fans mounted on the unit.

The tubes have extended surface called fins which significantly increases the Heat Transfer Area.



BENEFITS OF USING ACHE :

- Most preferred for Water Scared regions.
- Cooling Tower foot-print size is reduced.
- Reduction overall water consumption less than 3.0 lit/lit.

Savings through ACHE



Saving for a typical plant

Plant Capacity - 200 KLPD AA

ACHE Provided for vapor from Analyzer, DG and Evaporation Effects

Make up water & Power savings:

| Sr. No. | Parameter | W/o ACHE | With ACHE | Benefits |
|---------|--|----------|-----------|---------------|
| 1 | Soft Water m ³ /day (After process stream recycle) | 500 | 200 | 60% Savings |
| 2 | Soft Water lit/lit Al. (After process stream recycle) | 2.5 | 1.0 | 1.5 Savings |
| 3 | Power kWh | 240 | 221 | 8.0 % Savings |

Thank you

