Urea Casale technologies for urea plant revamping

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Presentation outline

- UREA PLANT REVAMPING TECHNOLOGIES
- CASE STUDIES
- CONCLUSION

Urea plant revamping

CASALE revamping philosophy focused on:

- Upgrading the plant with new technologies
- Maximizing efficiency of most important plant section
- Minimize modifications to existing equipment

Urea plant revamping

MAIN TYPOLOGIES OF REVAMPING

- Energy Saving
- Pollution control
- Product Quality Enhancement
- Capacity increase
- Integration between melamine and urea

Energy Saving projects

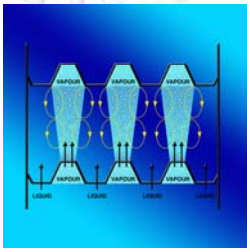
Improve the plant efficiency with low investment:

- Improve the key components
- Improve the energy integration

Energy Saving projects

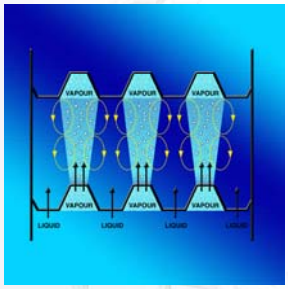
CASALE-DENTE High Efficiency Trays

- 1991-1992: development of Casale-Dente HET
- 1993: first application of Casale-Dente HET in Russia
- 2007: 52 sets of Casale-Dente HET on stream



Energy Saving projects

CASALE-DENTE High Efficiency Trays



- Separate & distributed paths
- High vapor/liquid mixing
- Small bubble
- Large exch. surface
- Short streamlines

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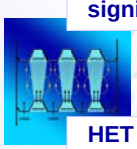
Energy Saving projects

CASALE-DENTE High Efficiency Trays



significant increase in CO_2 conversion

HET Used to:

- decrease the steam consumption
- increase plant capacity

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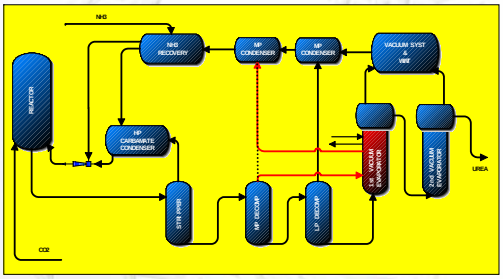
Energy Saving projects

Heat integration



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Pollution abatement

Remove pollutants (mainly NH3) from:

- Inerts vents
  Appropriate scrubbing system according to Casale know-how and experience
- Excess process condensate
  Casale proprietary hydrolyser

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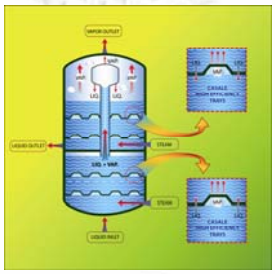
Pollution abatement

High Efficiency Hydrolyser

- 1993-1994: development of Casale HEH
- 1995: first application of Casale HEH in Canada
- 2007: 14 Casale HEH applications, 7 on stream



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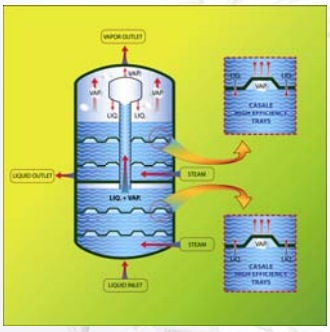
High Efficiency Hydrolyser



First part co-current

Second part counter-current

MP steam can be used

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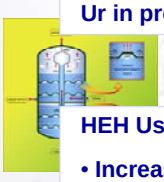
High Efficiency Hydrolyser



Ur in process condensate down to 3 ppm

HEH Used to:

- Increase efficiency of existing hydrolysis sections
- increase capacity of WWT section

Product quality enhancement

- Collaboration with major designers of technology for finishing section
- Ongoing development programs for new technologies for improving product quality

Capacity increase

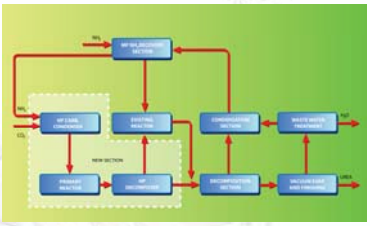
Increasing plant efficiency by upgrading it becomes essential to minimize investment

- Small/moderate capacity increase HET are the most appropriate choice
- Large capacity increase various technologies have been developed to maximize plant efficiency boost

Capacity increase

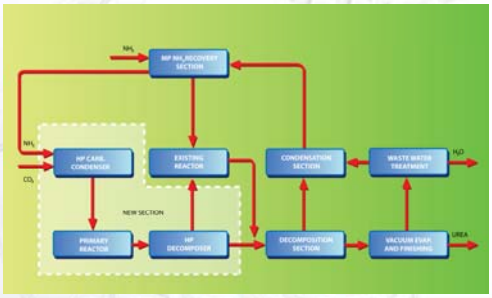
HEC process

- 1992-1994: development of Casale HEC process
- 1995: first plant revamped with the Casale HEC process
- 2007: 9 applications of HEC process, 6 on stream



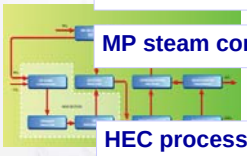
Capacity increase

HEC process



Capacity increase

HEC process



CO_2 conversion will rise up to 72 %

MP steam cons. down to 900 kg/MT

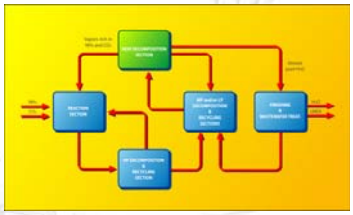
HEC process used to:

- increase capacity of conventional total recycle plants by 50-60 % and more

Capacity increase

VRS process

- 1994-1995: development of Casale VRS process
- 1996: first plant revamped with the Casale VRS process
- 2007: second plant under revamping



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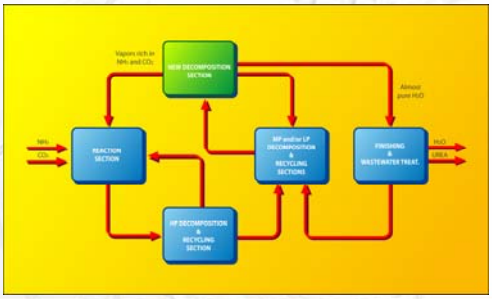
Capacity increase

VRS process



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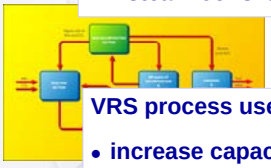
Capacity increase

VRS process

High CO_2 conversion (66 %)

MP steam cons. ab. 800 kg/MT



VRS process used to:

- increase capacity of stripping plants by 50-60 % and more

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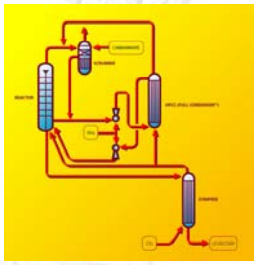
Capacity increase

FULL CONDENSER ™ – SPLIT FLOW LOOP ™

- 2000-2002: development of Split Flow / Full Condenser concepts.
- 2003: first plant revamped with Split Flow / Full condenser
- 2007: 5 projects are under implementation



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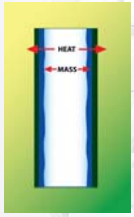
Capacity increase

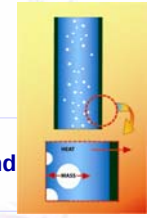
FULL CONDENSER ™ design

- Transform existing **Falling Film** HPCC into **Bubble Flow** configuration



Falling film: low heat transfer coef.

Bubble flow: high transfer of heat and mass



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Capacity increase

FULL CONDENSER ™ design

Submerged condenser

Two-phase flow in tubes

Internal circulation

High exch. coefficient

Urea is formed

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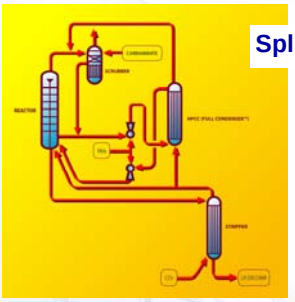
Capacity increase

FULL CONDENSER ™ design

- Vapors from bottom
- Two-phase upward flow
- Inerts separation at top
- Liquid exit from bottom
- Total condensation

Capacity increase

SPLIT FLOW LOOP™ design

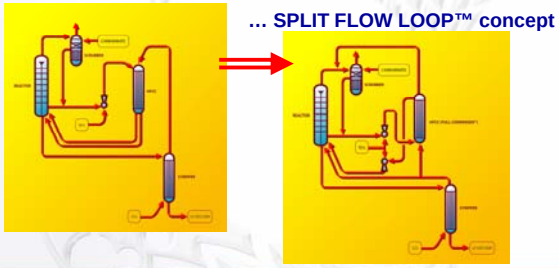


- Split of stripper vapors
- Majority to HPCC
- Minority to reactor

Capacity increase

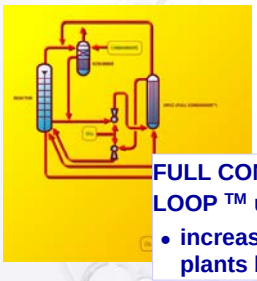
SPLIT FLOW LOOP™ design

Easy modification to …



Capacity increase

FULL CONDENSER ™ – SPLIT FLOW LOOP ™



- HT coef. increased by 50 %
- CO_2 conversion incr. by 2-3 %age points
- FULL CONDENSER ™ – SPLIT FLOW LOOP ™ used to:
  - increase capacity of CO_2 stripping plants by 50 % and more

Integration with melamine plant

A melamine plant, generally, is erected next to a urea plant so that:

- it can have easy access to the raw material
- it can easily recycle the off gas (NH3, CO2)

Impact of integration with melamine plant:

- higher capacity required to transform back to Ur the NH3 and CO2 from the off gas
- Lower efficiency reached in the sysntesis
- Higher load to the recycling section

Integration with melamine plant

Integrating a melamine plant in the most efficient way means:

- finding the best way of revamping the urea plant, minimizing also the efficiency loss.
- minimizing the additional water needed to condense the off-gas

Casale best copes with integration projects by:

- applying its revamping technologies
- applying its proprietary design for off gas condensation units

Case studies

1000 MTD CO_2 stripping plant revamping in Ukraine

First application of SplitFlowLoop/FullCondenser !

First revamping step in 1999 – from 1000 to 1350 MTD

Technology used:	**HET**
Casale supply:	**License** **Basic & Detailed eng.** **all equipment and materials**

Second revamping step in 2003 – from 1350 to 1500 MTD

Technology used:	**SplitFlowLoop/FullCondenser**
Casale supply:	**License** **Basic & Detailed eng.** **materials**

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Case studies

1500 MTD NH_3 stripping plant revamping in Russia

First revamping step in 2004 – energy reduction

Technology used:	**HET** **improved heat integration**
Casale supply:	**License** **Basic & Detailed eng.** **all equipment**

Second revamping step in progress – from 1500 to 2000 MTD and reduction of emissions

Technology used:	**High Efficiency Hydrolyser**
Casale supply:	**License** **Basic eng.** **major equipment**

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Case studies

1000 MTD Conventional total recycle plant revamping in Qatar

Capacity increase from 1300 to 1610 MTD with melamine plant integration

Technology used:	**HET** **HEC** **High Efficiency Hydrolizer**
Casale supply:	**Lump sum EP**

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Case studies

1500 MTD CO_2 stripping plant revamping in Abu Dhabi

Capacity increase from 1800 to 2700 MTD and melamine plant integration

Technology used:	**HET** **SplitFlowLoop/FullCondenser** **High Efficiency Hydrolizer**
Casale supply:	**License** **Basic & Detailed eng.** **major equipment**

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Case studies

IDR stripping plant revamping in Poland

Capacity increase from 1700 to 2000 MTD with melamine plant integration

Technology used:	**HET** **VRS**
Casale supply:	**License** **Basic eng.** **all equipment**

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Conclusions

Efficient urea plant revamping can be made using Casale technologies and know-how

Casale continues to focus on technological development combining, more and more, ideas with sophisticated modelling capabilities

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