I. Introduction

- Energy consumption reduction approaches
  Process intensification: Use of advanced technologies
  Process integration: Total Site Integration (TSI) to maximize heat recovery through the plant

- Industrial site application
  Wider project led to the identification of a distillation sequence as the main consumer of the plant. Two other sequences are investigated for step-change to DWC.

- Originality of this work
  Combination of an advanced distillation technology (Dividing-Wall Column) and TSI to assess if additional savings can be realized through its integration.

II. Dividing-Wall Column (DWC)

- Effective way to separate multicomponent mixtures in only one shell
- Theoretical 30% energy and 25% capital savings
  Due to reduced remixing effects and lower quantity of equipment needed
- Reduced integration potential compared to a conventional sequence
  Only one pressure is available for modifications, and utilities have only two temperature levels, instead of four in a conventional sequence.

III. 1st DWC targeting methodology

- Goal: Combine the profiles of DWC sections to obtain the DWC T-H profile
  - Based on 2-columns model: Two profiles to process
  - Transfer from Aspen Plus to Matlab and conversion into composite curves
  - Removal of features that virtually increase DWC consumption and combination of the profiles

IV. Industrial applications results

- Sequence 1 (C-1 and C-2)
  The current sequence performs heat recovery between the two columns, which allows more savings than the DWC, from the unit and TSI points of view. This sequence is therefore well implemented.
- Sequence 2 (C-3 and C-4)
  The DWC 2 consumes 38% less energy than the current sequence (800kW heating and cooling). With TSI, the results stay better, but the better integration of the current sequence reduces the gap.
- Sequence 3 (C-4 and C-5)
  An unexploited recovery potential between the two columns allows more savings (345kW heating and cooling) than the implementation of a DWC. As with Sequence 1, heat recovery is more interesting than DWC when the temperatures are compatible.
- Combination of DWC 1 and 2
  The TSI analysis shows a savings potential accounting for 25% of the MER, usable by Mechanical vapor recompression. However, the potential does not exist in reality. It is caused by a conflict between the concepts of T-H profile and composite curve.

V. 2nd DWC targeting methodology

- Goal: Identify the best side-exchange target
  1. Selection of a profile calculation method
     - Dhole and Linnhoff: easy implementation, but risk of errors
     - Soares Pinto: Unique profile, but difficult implementation and calculations
  2. Prefractionator T-H profile processing
     - Closed pocket: No target considered
     - Pinched profile: Side exchange targets
  3. Main column T-H profile processing
     Removing of the closed pockets caused by the column configuration to keep only the section allowing side exchange targeting
  4. MERS calculation
     Using target from prefractionator or main column
  5. Selection of the best target
     Based on the MER values

VI. Conclusions

- Industrial
  1. Sequence 1 well chosen
  2. 800 kW heating and cooling savings by replacing sequence 2 by DWC 2
  3. 345 kW heating and cooling savings by performing heat recovery in sequence 3

- Theoretical
  1. No calculation profile method is currently suitable and validated for DWC
  2. Column T-H profile and composite curve are two distinct concepts even though they are represented the same way
  3. A new methodology for DWC targeting is presented, but not currently validated

- Future work
  1. Validate Soares Pinto calculation method with DWC
  2. Validate 2nd DWC targeting methodology
  3. Verify the targets by utility integration after MER calculation

Author: Romain Brunner
Supervisor: François Maréchal
Assistant: Nasibeh Pouransari
Acknowledgements: Gerald Bocquenet
Rakesh Agrawal