

Process calculation tool for pervaporation membranes

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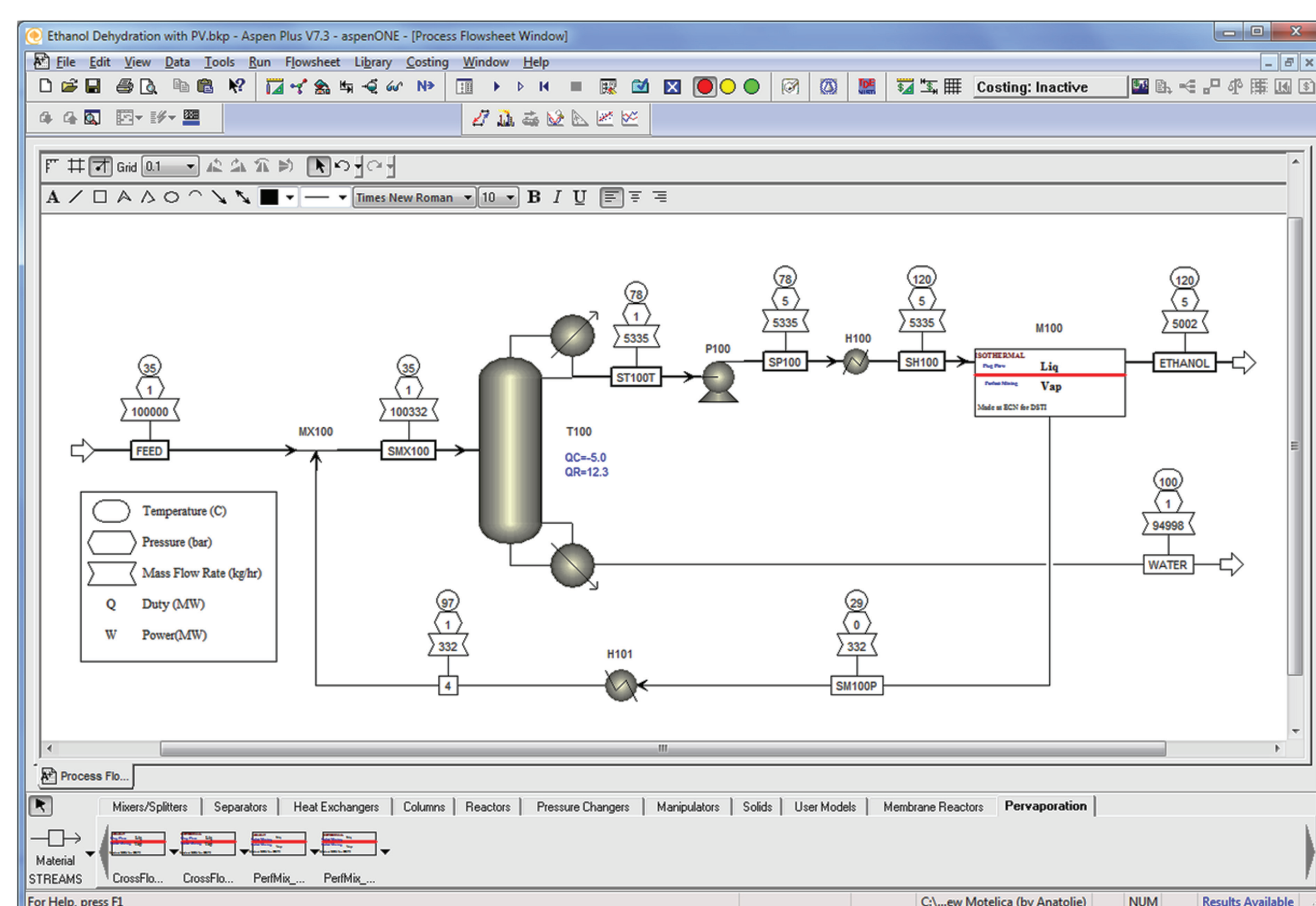
Background

- Pervaporation is a low cost alternative for distillation in e.g. the separation of azeotropic mixtures.
- End users require prediction tools for process design, and evaluations.
- Today no suitable tool is commercially available.

Objective

- Develop a general applicable pervaporation simulation tool.
- Make a unit operation in Aspen Plus.

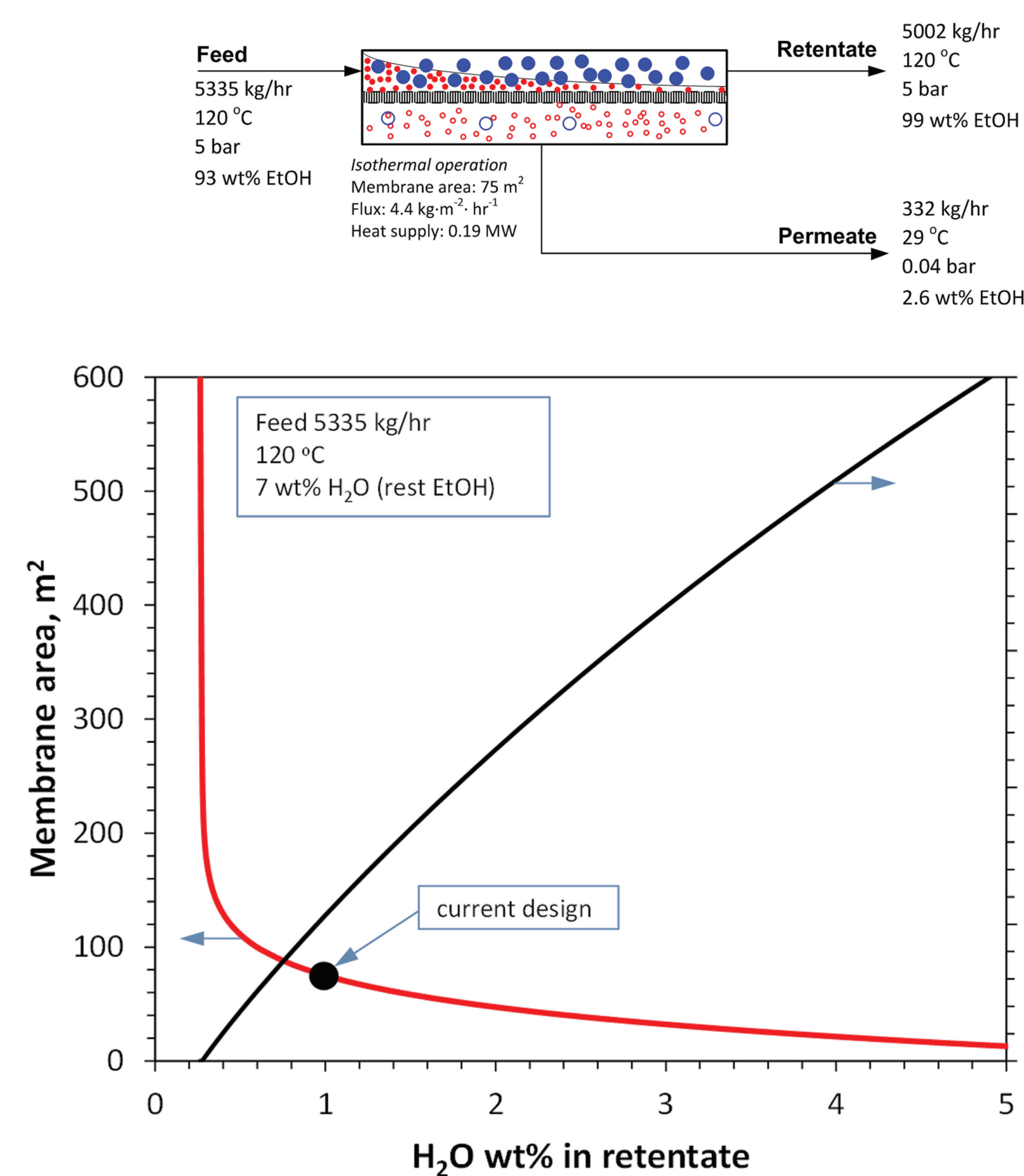
Example: Bioethanol purification



Typical process conditions

- Purification of 100 ton/hr of fermentation broth with 5 wt% ethanol.
- Demanded purity 99 wt% ethanol.
- Ethanol – water azeotrope at 96 wt% ethanol.
- Most used technology to break azeotrope involves molecular sieves.

Typical results pervaporation tool



Pervaporation model features

- Simulation in adiabatic/isothermal regime with various flow patterns.
- Model requires limited experimental input.
- Add-in to Aspen Plus, with full access to physical properties and thermodynamic data.
- Allow for sensitivity and optimization studies.
- Typical results are membrane area, flux, selectivity/separation factor, heat demands etc.
- Robust calculations, even for multicomponent mixtures and complex flow patterns.
- Flexible, easy adjustable for any membrane type.

Reference

- [1]. Lipnizki et al., (1999), Pervaporation-based hybrid process: a review of process design, applications and economics, J. of Membr. Sci., 153, p.183-210.
- [2]. Alvarado-Morales, M., et al., (2009), Biorefining: Computer aided tools for sustainable design and analysis of bioethanol production, Chem. Eng. Res. and Des., 87, p.1171-1183.
- [3]. Schiffmann et., (2011), Design of pervaporation modules based on computational process modeling, Proc. 21st ESCAPE conference, 29 May - 1 June, Porto Carras Resort, Chalkidiki, Greece.

Summary

- The model has been used successfully in various applications.
- The model can be acquired at ECN.
- ECN can also provide consultancy and process evaluation for your specific case.

Acknowledgments

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