



# Semi-Batch Design for the Production of Nylon 6 6

## AKA Engineers

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### Introduction

#### Market:

- Two biggest markets: electronic and automotive industry
- The use of Nylon 6 6 in automotive manufacturing is continuously increasing

#### Product:

- Standard injection molding grade granulated Nylon 6 6
- For use in the automotive industry

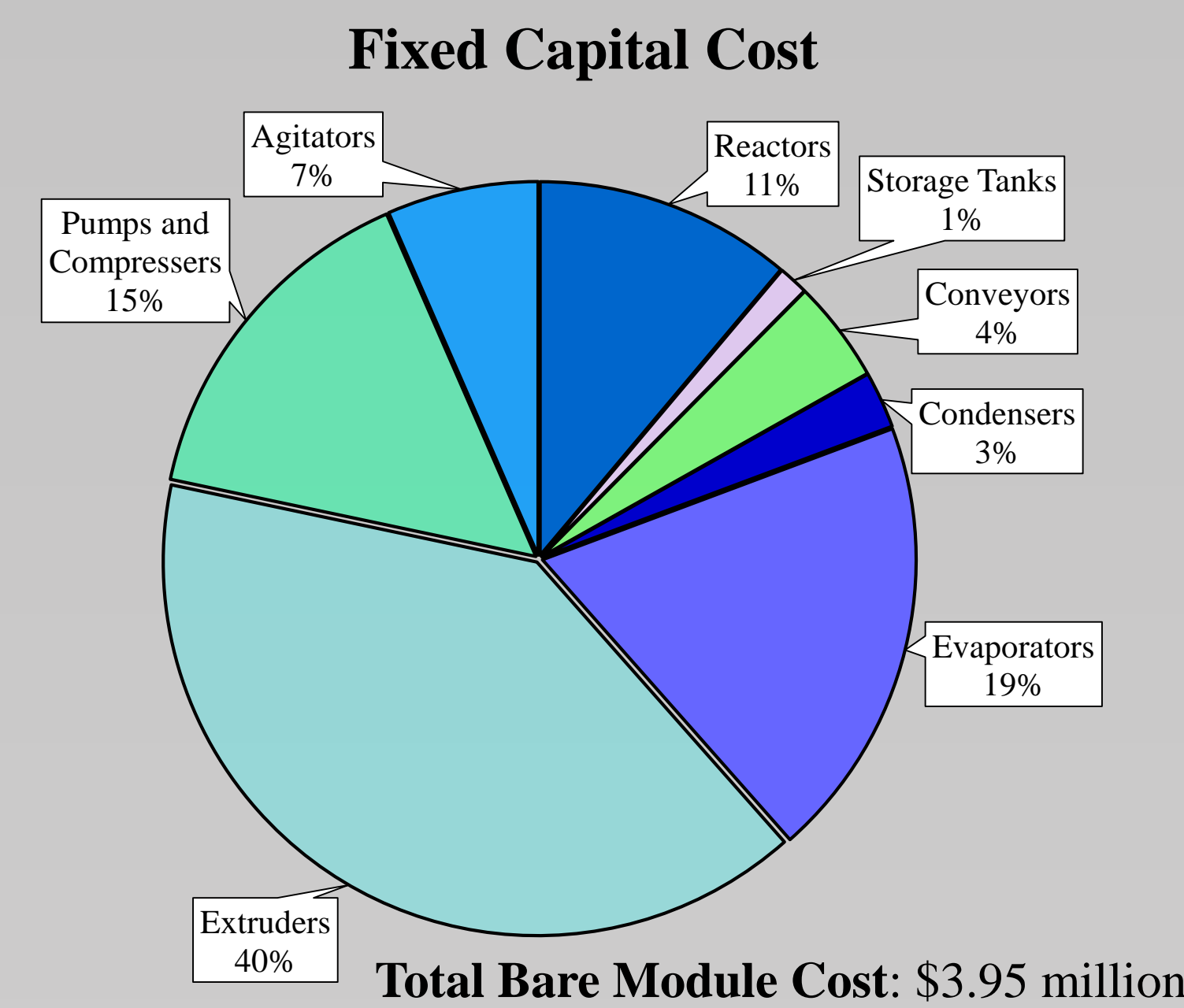
#### Critical to Quality Variables:

- Molecular Weight: 80,000 g/mol
- Density: 1140 kg/m<sup>3</sup>
- Tensile Modulus: 3000MPa under dry conditions
- Impact Strength: 5 kJ/m<sup>2</sup>

#### Annual Capacity:

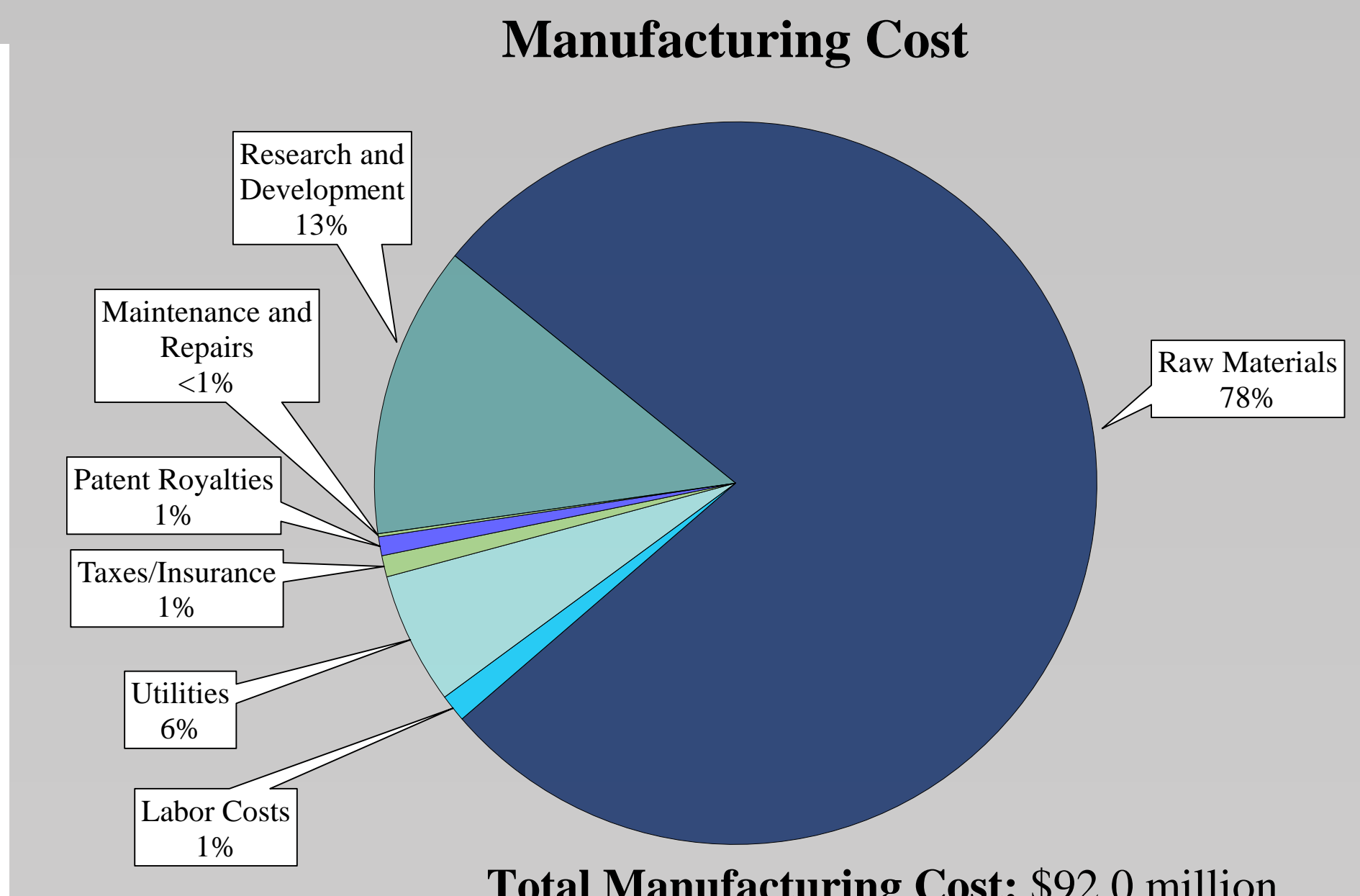
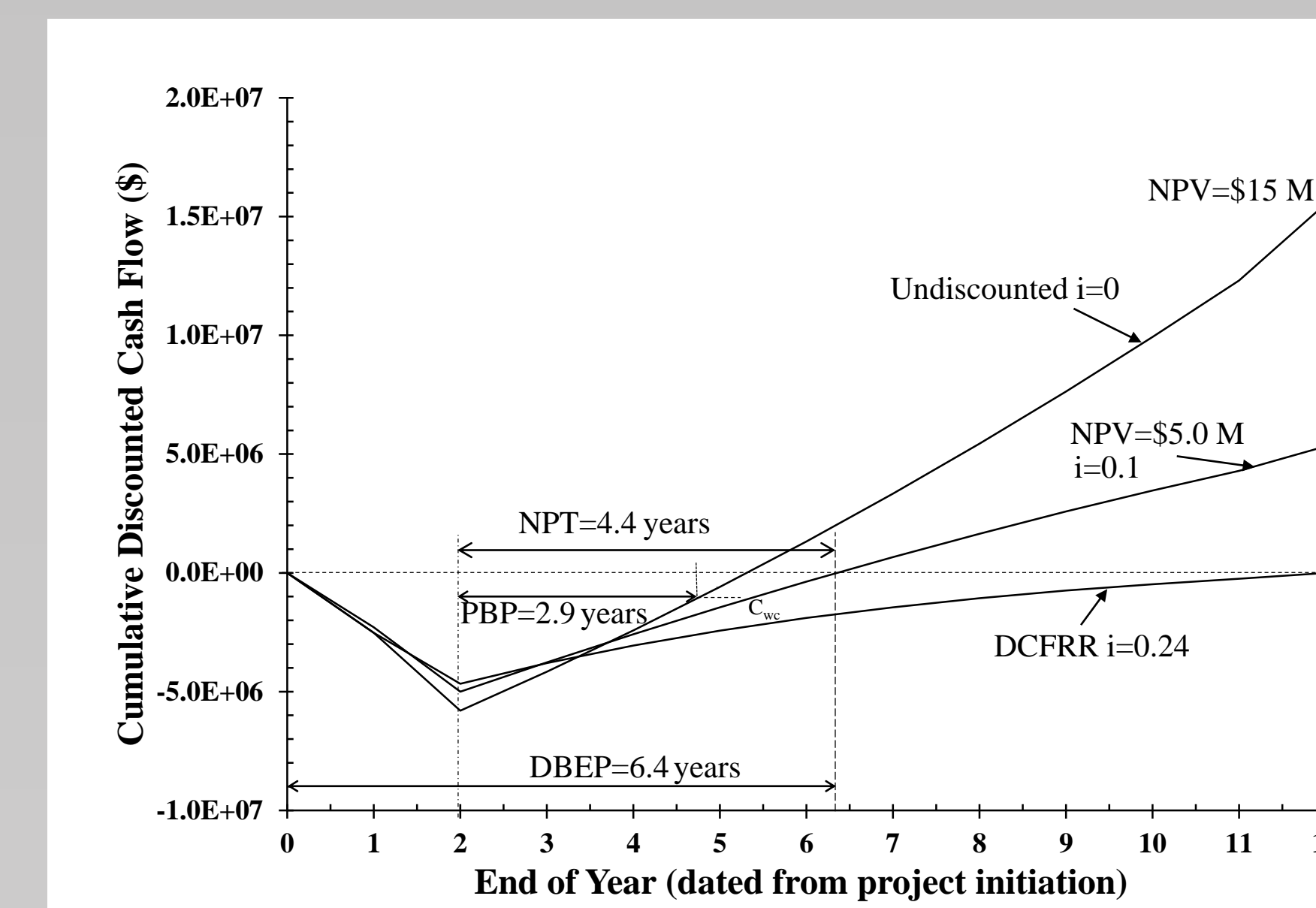
- 100%: 85 million lbs (39 million kg)
- 67%: 57 million lbs (26 million kg)

#### Location: Calvert City, Kentucky



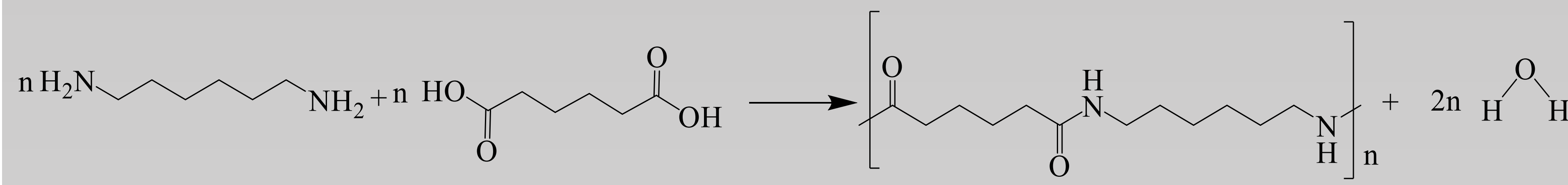
- Grass Roots Cost: \$5.05 million
- Total Capital Investment: \$5.81 million

### Economic Analysis

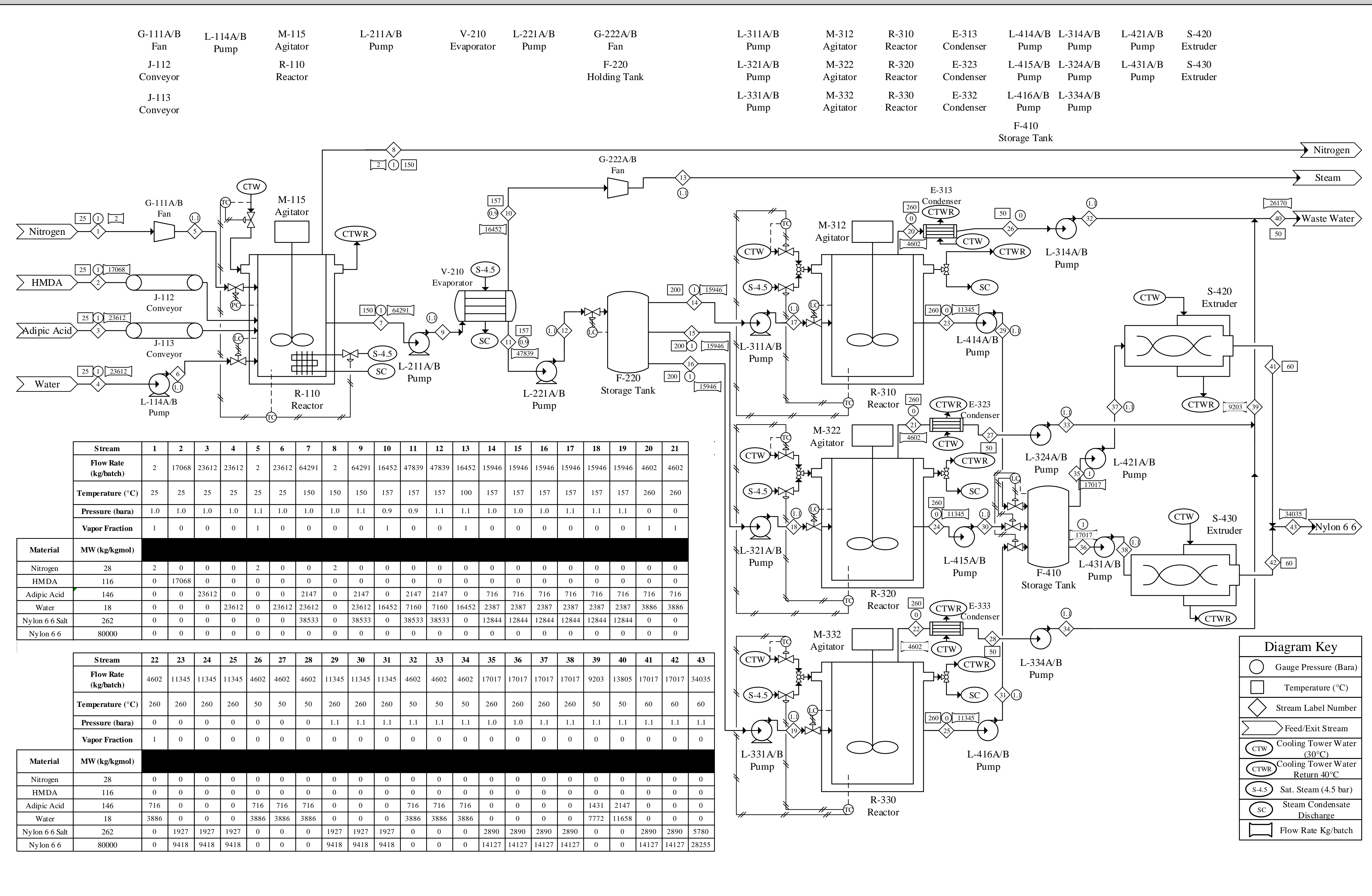


- Plant is under construction for 2 years and operates for 10 years

- Market Price \$2.45/kg
- Net Annual Profit \$1.92 million
- After tax rate of return 49.7%



### Process Flow Diagram

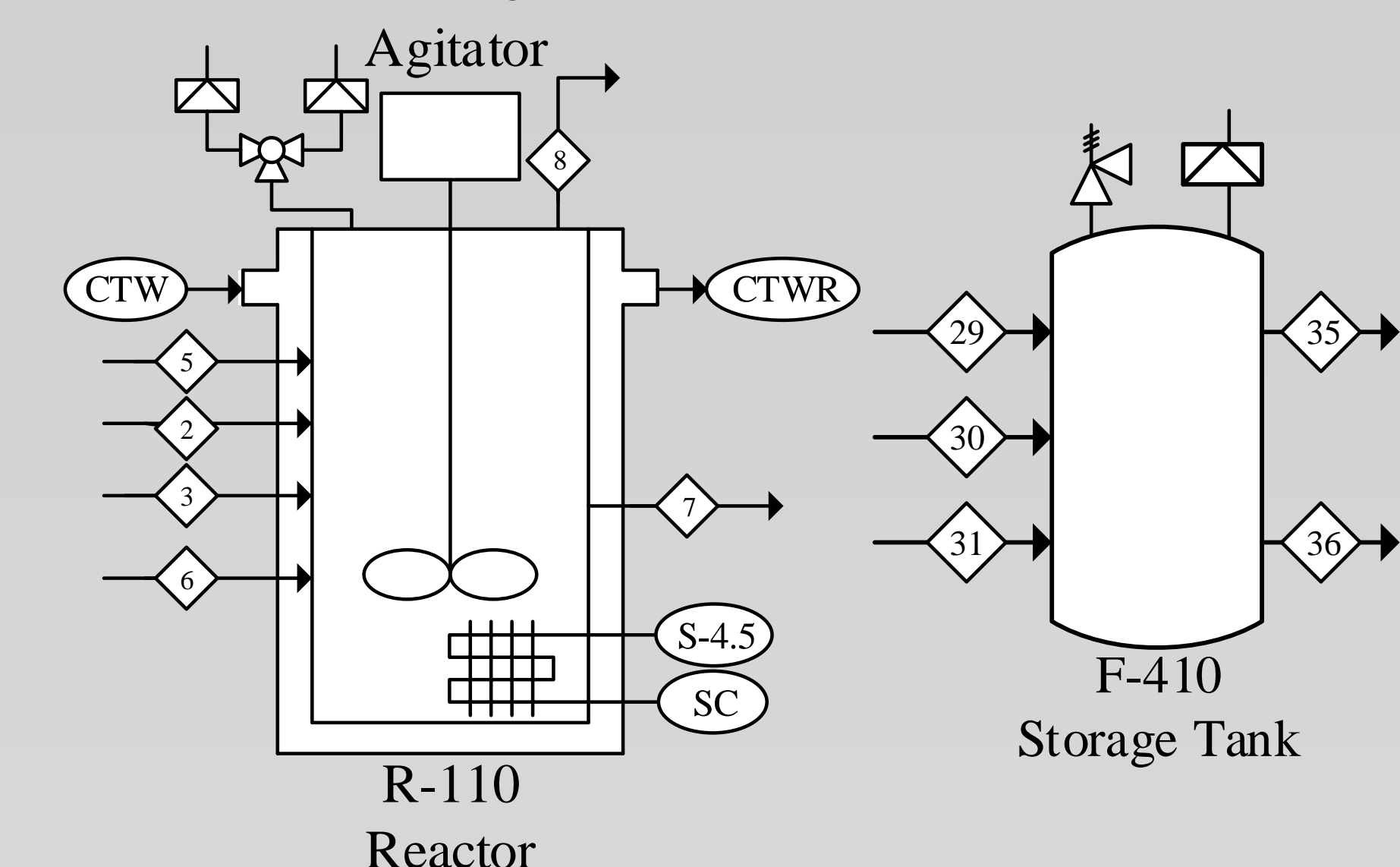


### Safety Evaluation

#### Inherent Safe Design

- 3 polycondensation reactors used
- Control loops regulating pressure, temperature, and level were designed to simplify operator procedures
- Relief valves designed
- Initial HAZOP Report completed around polycondensation reactors

#### Relief Valves



### Conclusion

- Plant is a GO
- Net annual profit \$1.92 million with an after-tax rate of return of 49.7%
- DCFRR: 24%
- Control loops and relief valves designed around major pieces of equipment to make the design inherently safe

### Acknowledgments

- Our families and friends for their support
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### References

- UNITIKA LTD., "UNITIKA NYLON66: Standard nylon," [Online]. Available: <https://www.unitika.co.jp/plastics/e/pdf/A125.PDF>. [Accessed 4 April 2017].