

# Refrigerant Management: Financial Analysis of Reducing Greenhouse Gases through the Montreal Protocol

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## Why Manage Refrigerants?

- Many chemicals and aerosols used for refrigeration are potent greenhouse gases, sometimes 1000 times more powerful than carbon dioxide.<sup>1</sup>
- Use of refrigerants called hydrofluorocarbons (HFCs) is increasing 10-15% annually.<sup>1</sup>
- Reducing these refrigerants is essential to curbing global temperature increases.
- *The Montreal Protocol on Substances that Deplete the Ozone Layer* is an international treaty mandating the phase-out of refrigerants that harm the ozone layer or have global warming potential, such as hydrochlorofluorocarbons (HCFCs) and HFCs.

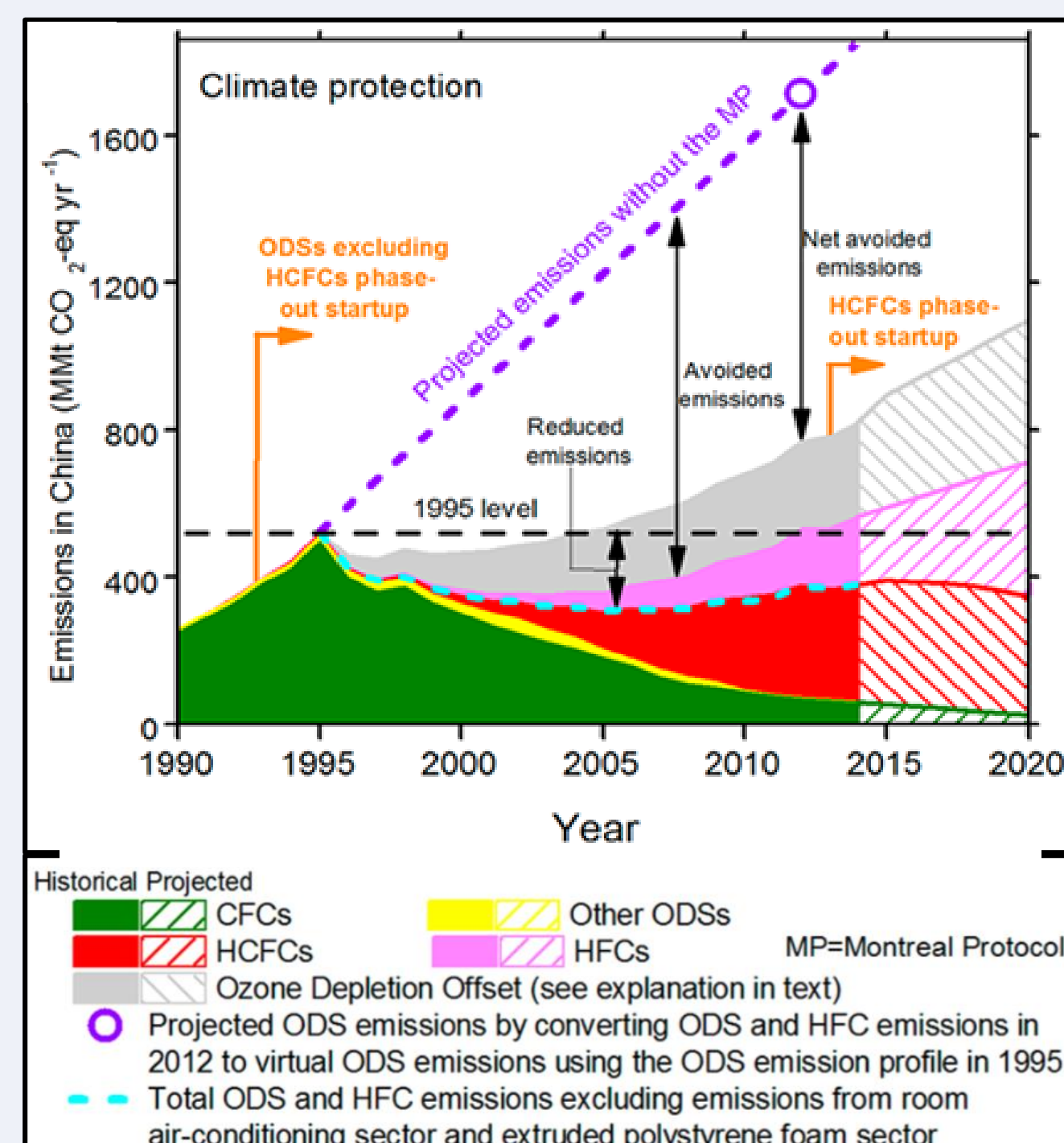


Figure 1. Projected HCFC emissions in China with and without the Montreal Protocol.<sup>2</sup>

## Objectives

- Evaluate changes in budgeting and spending to project future costs of the Montreal Protocol and its Multilateral Fund (MLF).
- Utilize findings to refine a cost-benefit analysis that assesses refrigerant management worldwide across multiple decades.

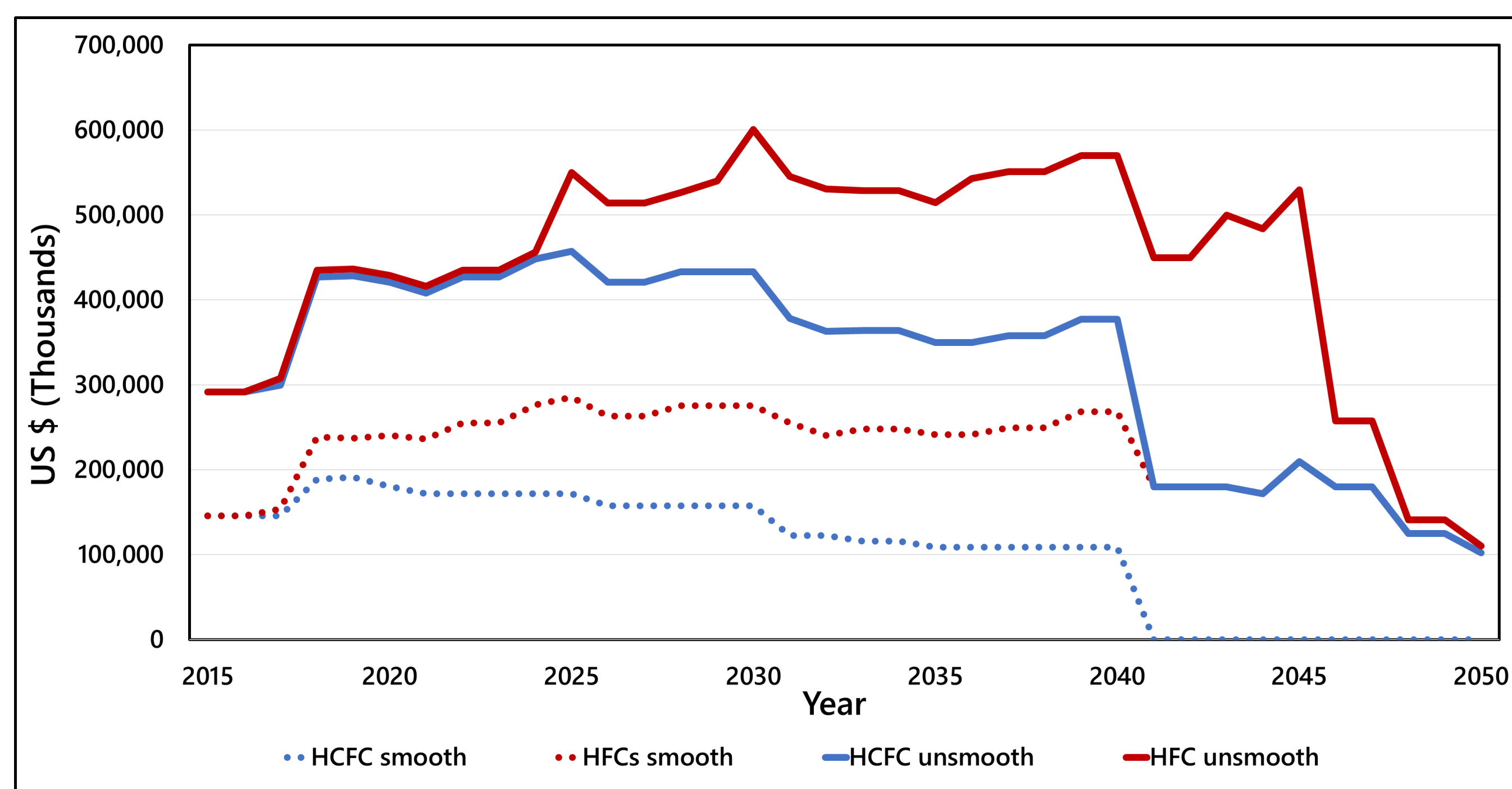


Figure 2. Cost model predictions for spending on HCFCs and HFCs until HFC phase out in 2050

## Methods

- We analyzed Business Plan and Progress Report documents, reviewing predicted and actual spending (Fig. 3, 4).
- We compiled data on predicted, approved, and disbursed funds and explored fund allocation patterns.
- Using these trends, we will update the cost models to more accurately predict future spending.

## References

- <sup>1</sup> Zaelke et al. (2018, January 11). Primer on HFCs.  
<sup>2</sup> Fang et al. (2018). DOI: 10.1021/acs.est.8b01280

## Findings

### Standard Costs (Fig. 3)

- Increasing business plan predictions
- Spending increases marginally with inflation

### HCFCs (Fig. 4)

- Higher budget predictions in MLF replenishment years.
- Accurate spending predictions

### Further Research Required

- How disbursement delays influence approved funding
- Remaining cost to reach HCFC phase out

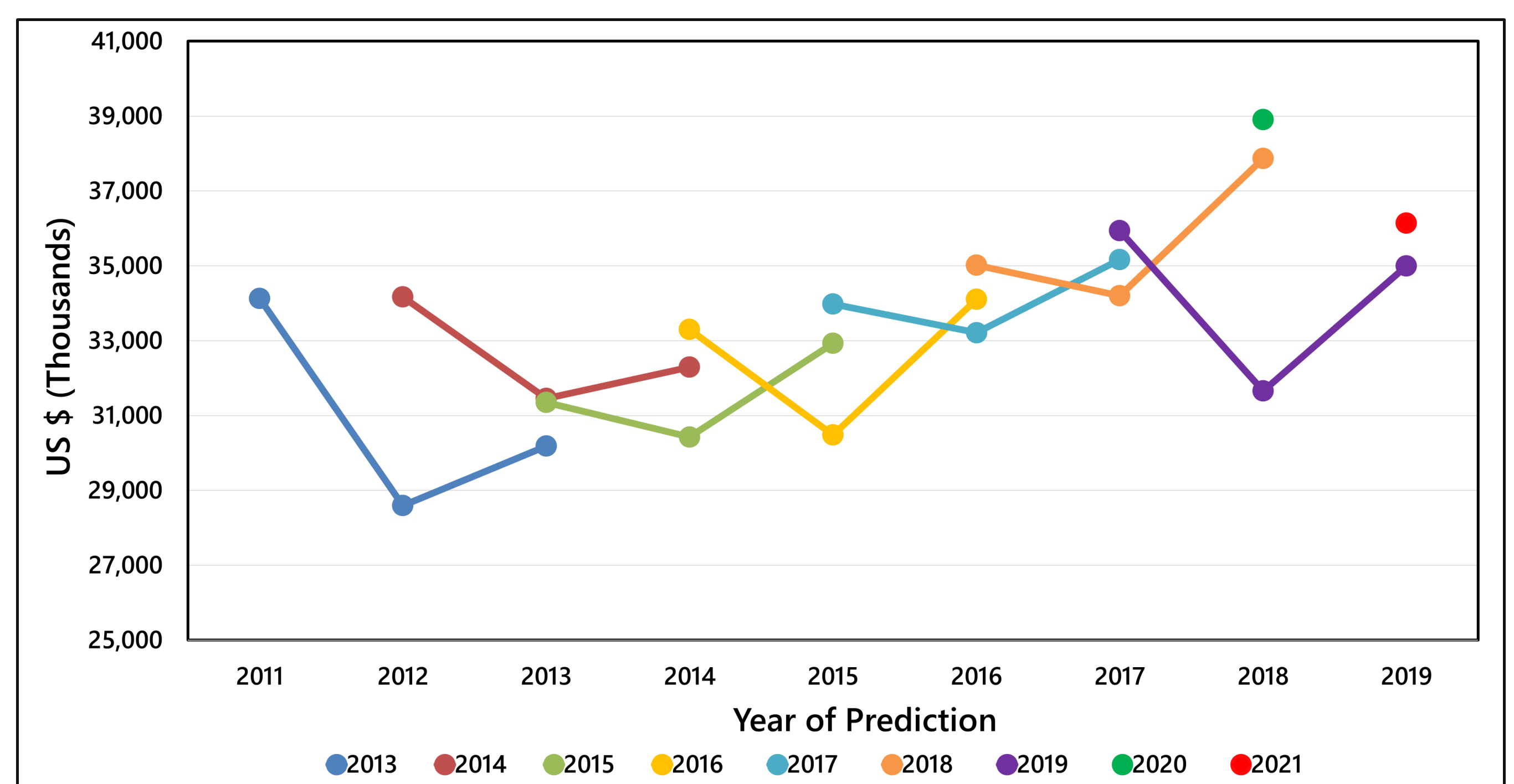


Figure 3. Standard costs from business plans from 2011-2019 to predict budgets in 2013-2021

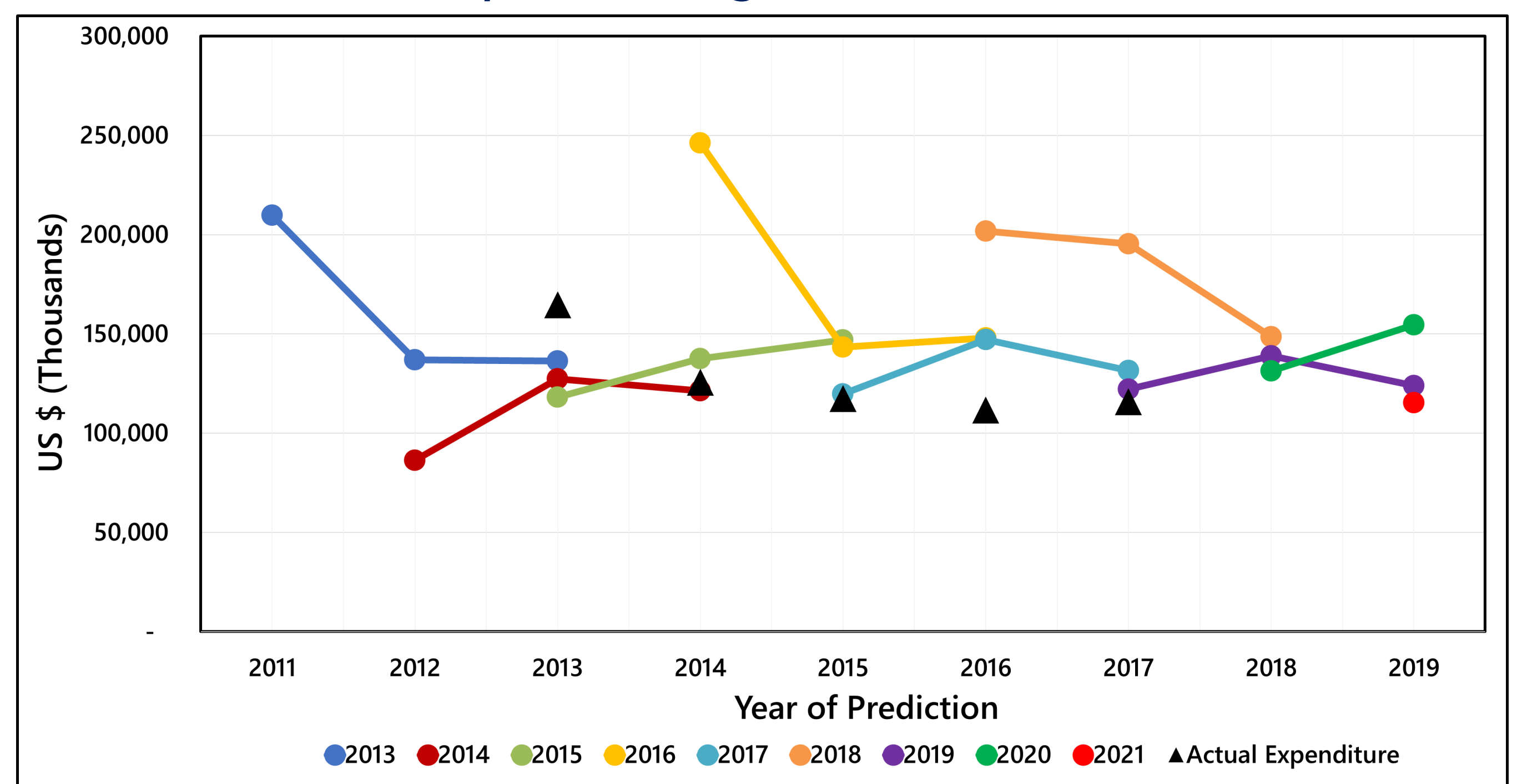


Figure 4. Annual required compliance costs for HCFC projects: predictions in business plans and actual expenditure, 2011-2019

## Implications

- Governments can utilize the cost model at future MLF meetings to simplify funding negotiations.
- We can use this model to calculate environmental cost/benefit compared to other climate mitigation efforts.
- **By managing HFCs, 0.5°C of warming can be avoided by 2100.<sup>1</sup>**

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