

# Reductions estimated to maintain standards attainment under climate change

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Modeling Workgroup 12/5/2019

# Climate Model System – relative change only

- PSC voted to not change planning targets until 2025
  - Still need to use CAST-2017 and CAST-2019
- PSC asked to evaluate climate change
- Climate change assessment models will be used to evaluate the ***change*** in attainability of standards due to climate change effects

# Method

- Using the Climate Model System, estimate the change in attainment due to all climate change effects
- Using the TMDL Model System, estimate the change in load necessary to counteract that change

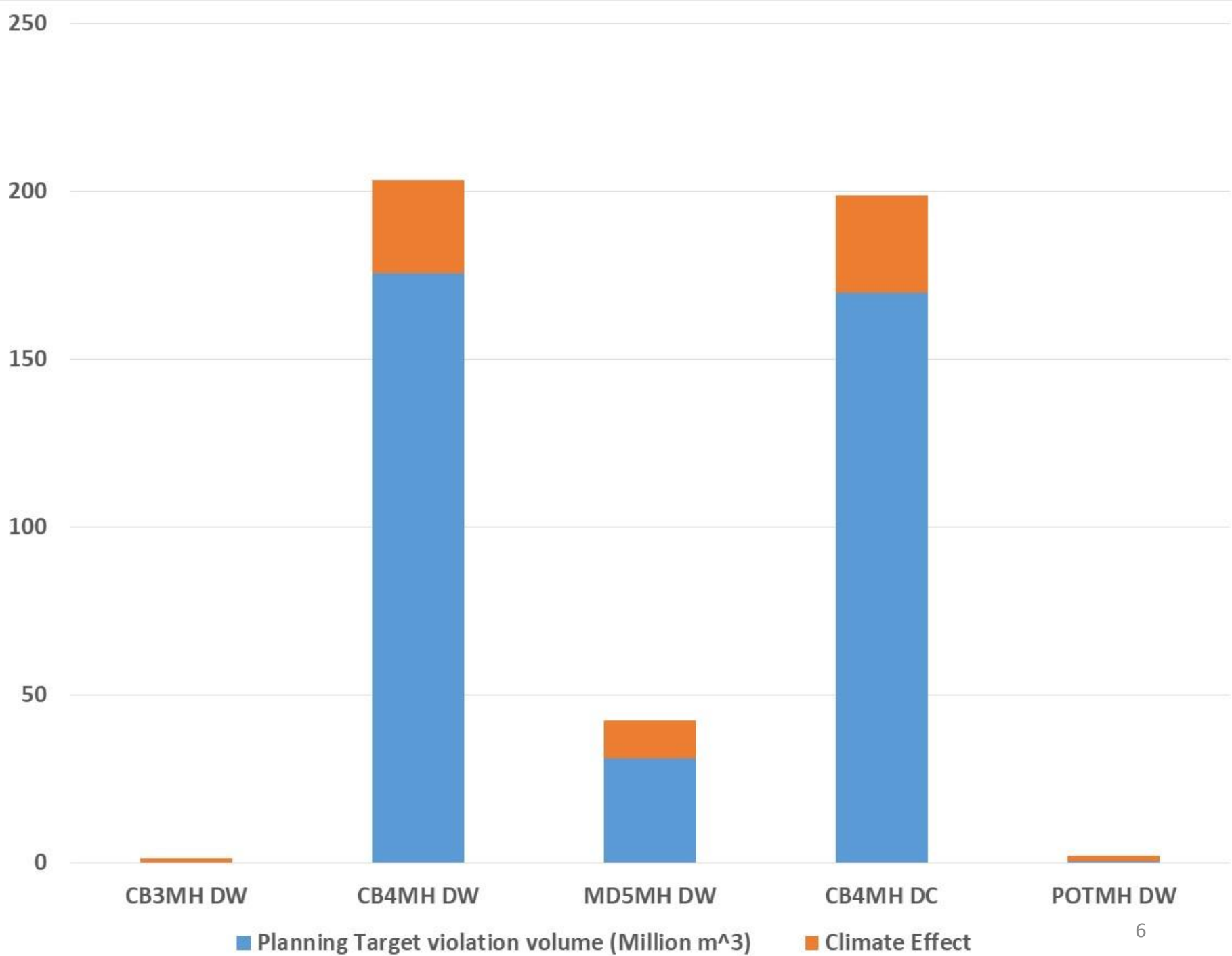
# Method Details

- Estimate the necessary load change from Susquehanna and then use the 'all else' planning target curve to distribute the load reduction.
- Method was used to distribute Conowingo loads for the four PSC Conowingo options
- Method was *suggested* for climate change at the December 2017 joint Modeling Workgroup / WQGIT meeting

# Scenario Results

Cbseg	State	DU	Climate Year				
			1995	2025	2035	2045	2055
CB3MH	MD	DC	0.00%	0.00%	0.00%	0.00%	0.00%
CB4MH	MD	DC	7.99%	9.36%	10.88%	12.50%	14.92%
CB5MH	MD	DC	0.00%	0.00%	0.00%	0.00%	0.00%
CB5MH	VA	DC	0.00%	0.00%	0.00%	0.00%	0.00%
CB3MH	MD	DW	0.05%	0.19%	0.24%	0.24%	0.29%
CB4MH	MD	DW	6.16%	7.13%	7.71%	8.11%	8.77%
CB5MH	MD	DW	1.50%	2.02%	2.44%	2.77%	3.06%
CB5MH	VA	DW	0.00%	0.00%	0.00%	0.00%	0.00%
POTMH	MD	DW	0.04%	0.12%	0.38%	0.72%	0.92%

- 1995 is different from runs used to set planning targets – different modeling system
  - WIP3 proportioned to planning targets
  - Growth curve
  - Speciation
- Only interested in the difference



# Climate increase in violation

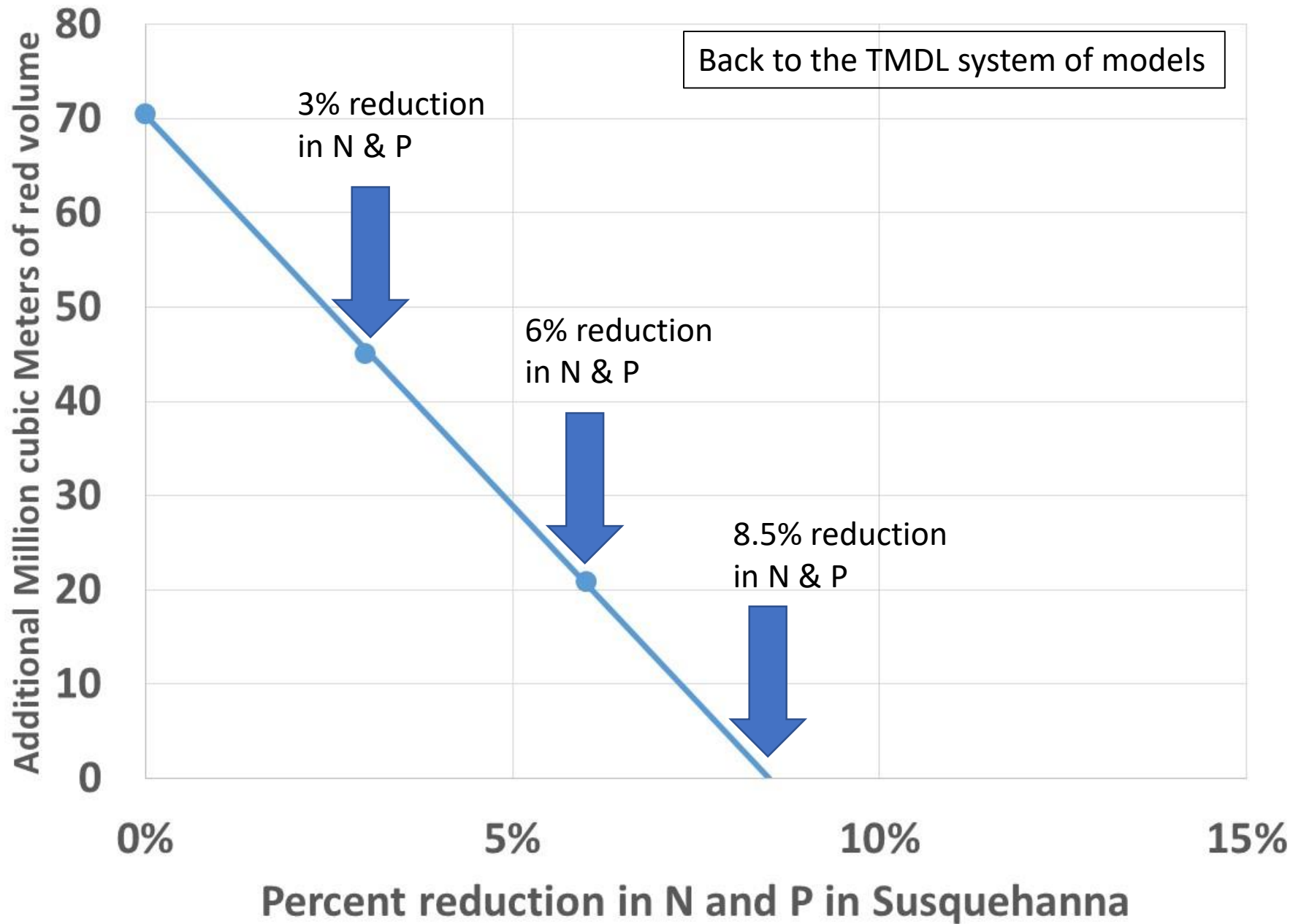
CB Seg	Designated Use	Designated Use Total Volume	Red Percent Planning Target	Red Volume Planning Target	Red Percent Planning target + CC	Red Volume Planning target + CC
CB3MH	DW	864	0.05%	0	0.19%	2
CB4MH	DW	2854	6.16%	176	7.13%	204
MD5MH	DW	2097	1.50%	31	2.02%	42
VA5MH	DW	1605	0.00%	0	0.00%	0
POMMH	DW	1839	0.04%	1	0.12%	2
CB3MH	DC	390	0.00%	0	0.00%	0
CB4MH	DC	2126	7.99%	170	9.36%	199
MD5MH	DC	2875	0.00%	0	0.00%	0
VA5MH	DC	1848	0.00%	0	0.00%	0
				378		449
					<b>CC Difference</b>	<b>71</b>

# Climate increase in violation

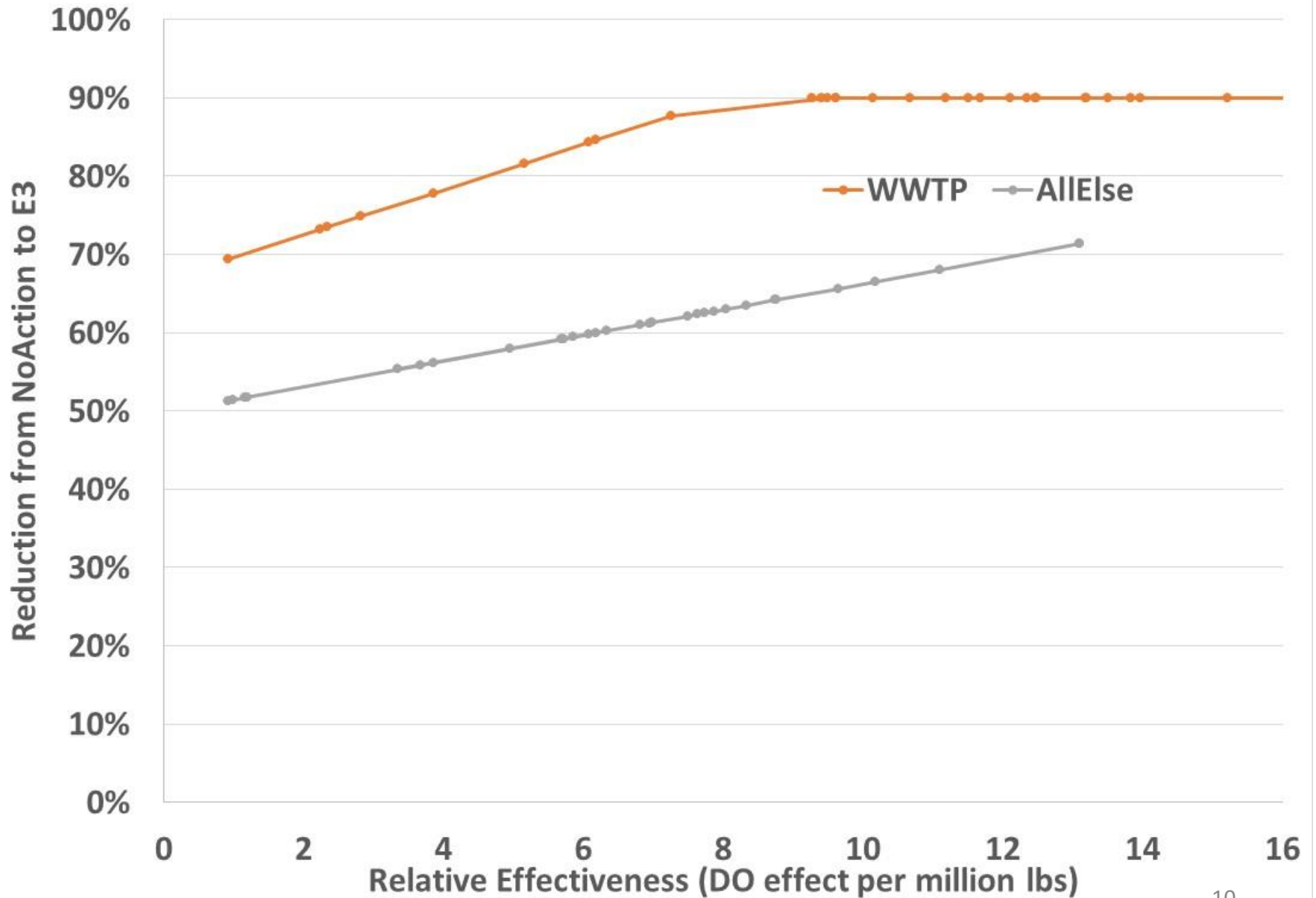
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		Use Total	Planning Target	Planning Target	Planning target	Planning target
		Volume			+ CC	+ CC
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				378		449
					<b>CC Difference</b>	<b>71</b>

71 million cubic meters is the final result from the climate modeling  
 Previous number was 80

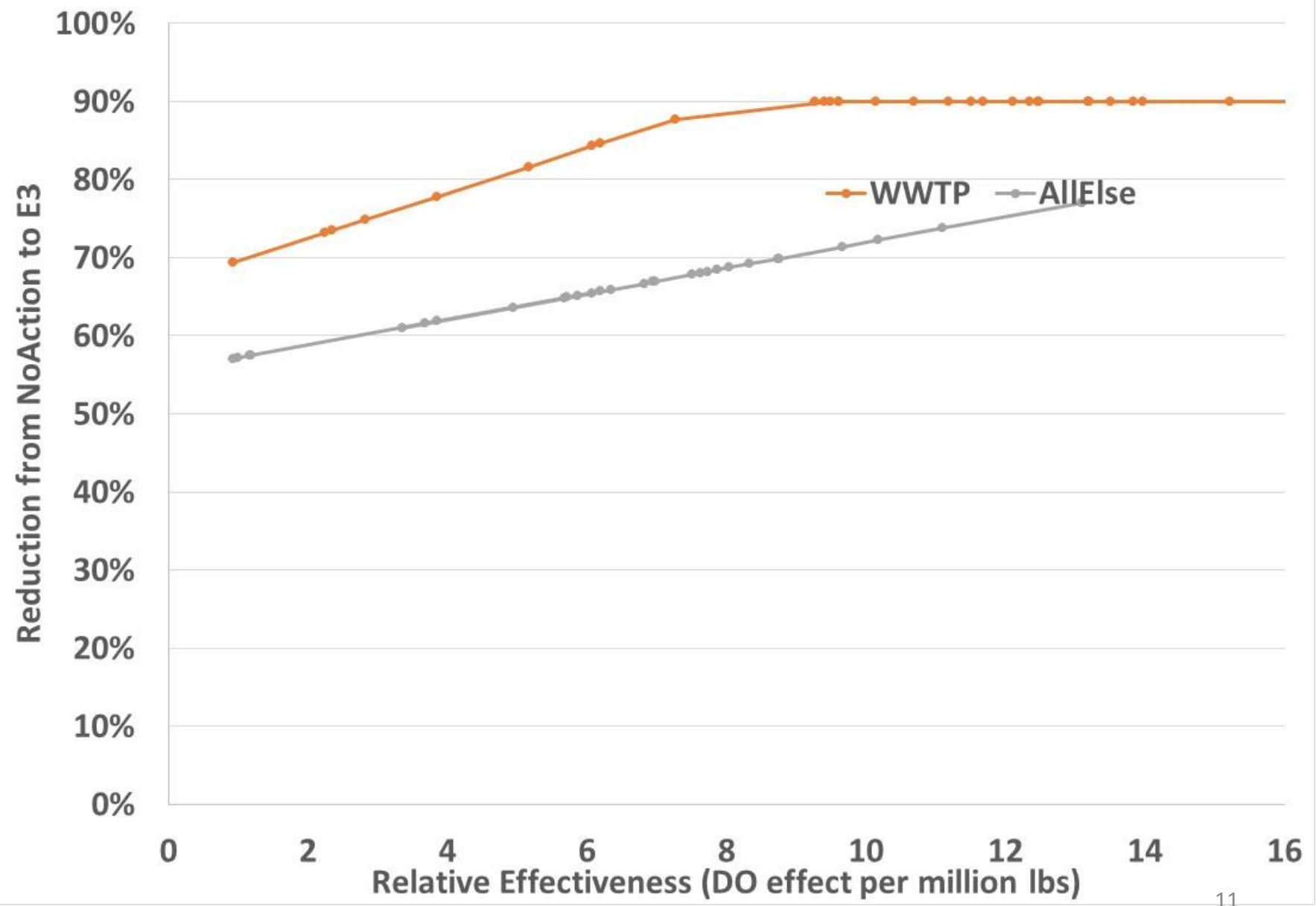




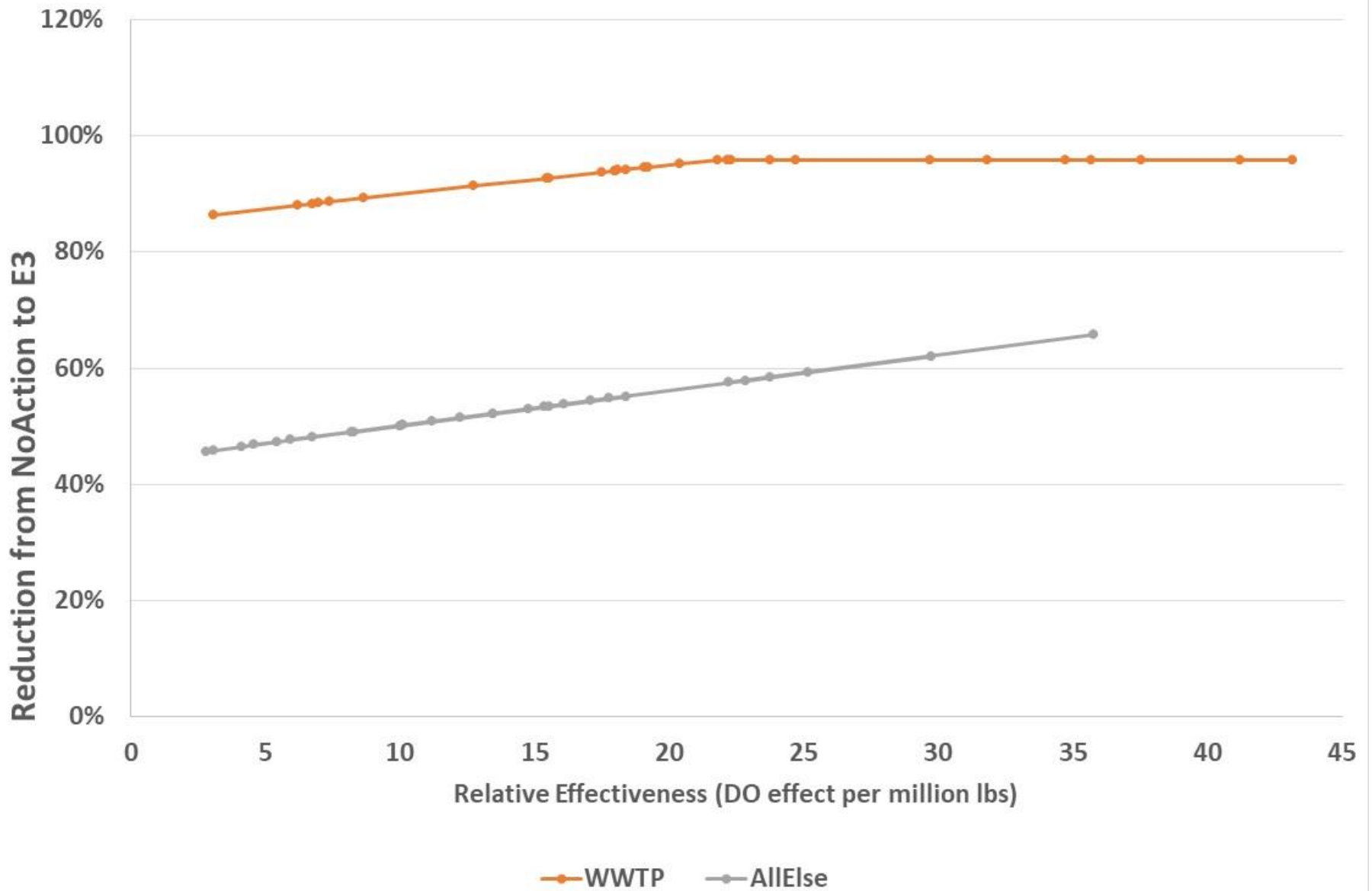
## Planning Target Calculation - Nitrogen



# Planning Target Calculation - Nitrogen 2025 Climate

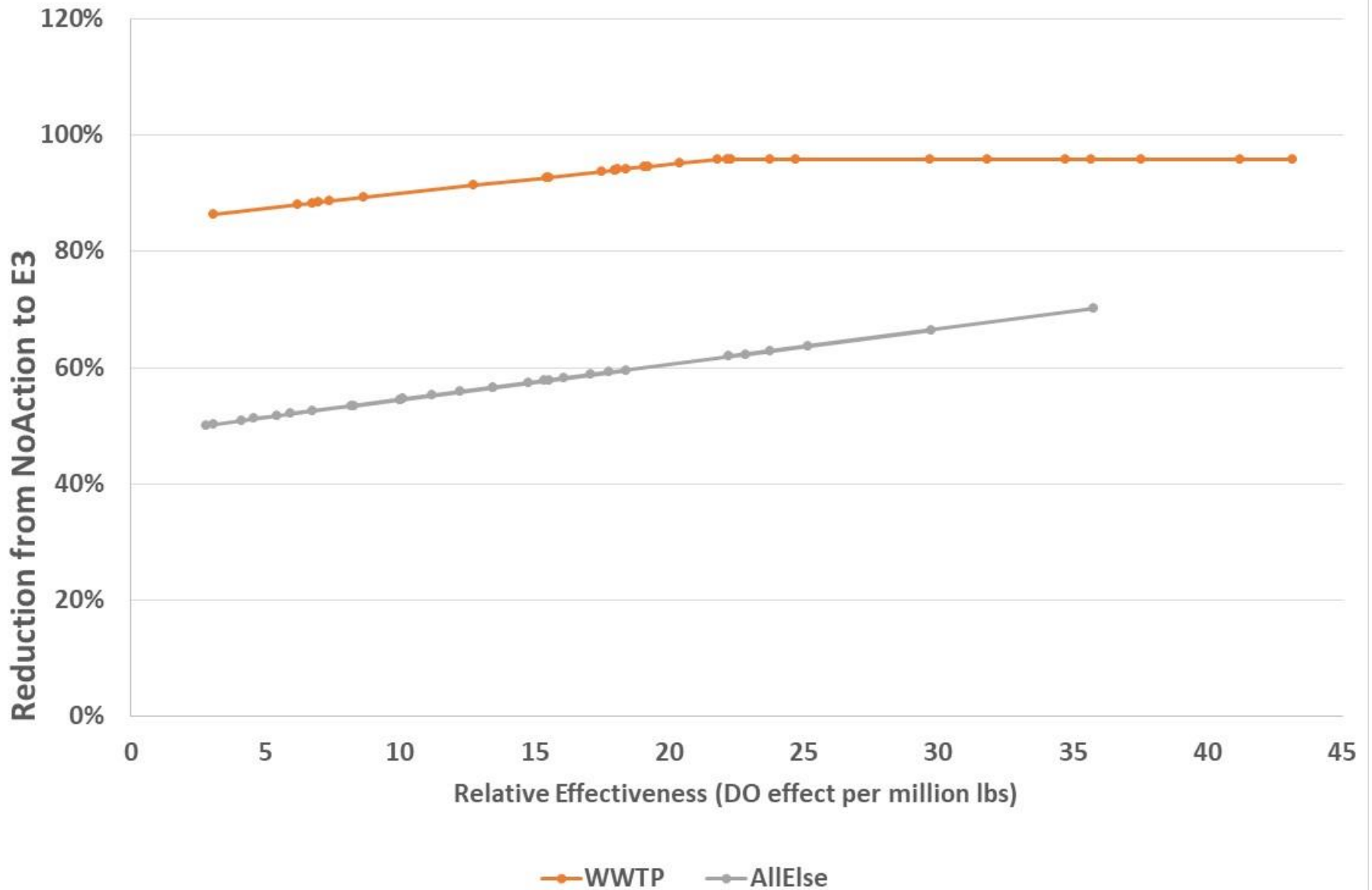


### Planning Target Calculation - Phosphorus



# Planning Target Calculation - Phosphorus

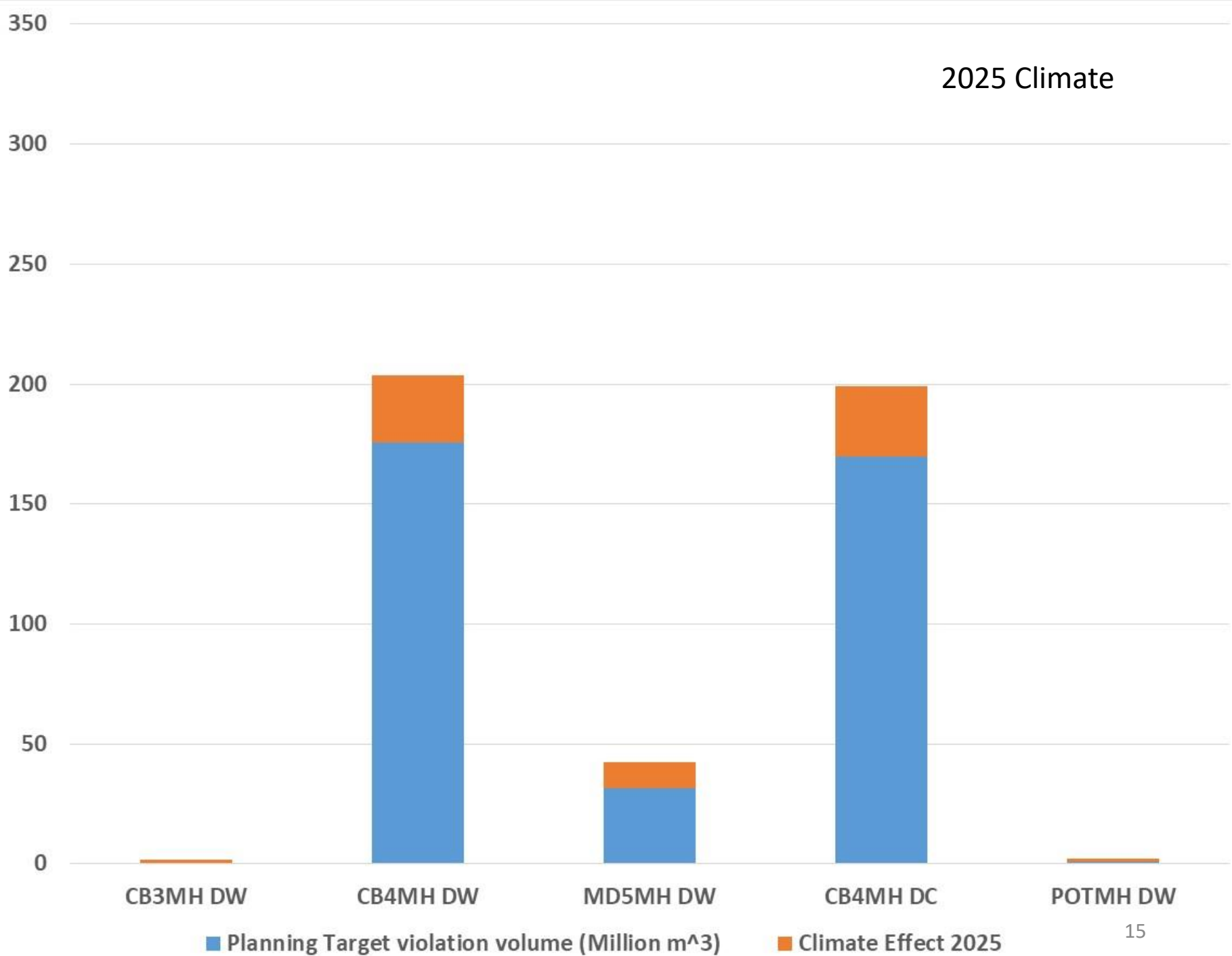
2025 Climate



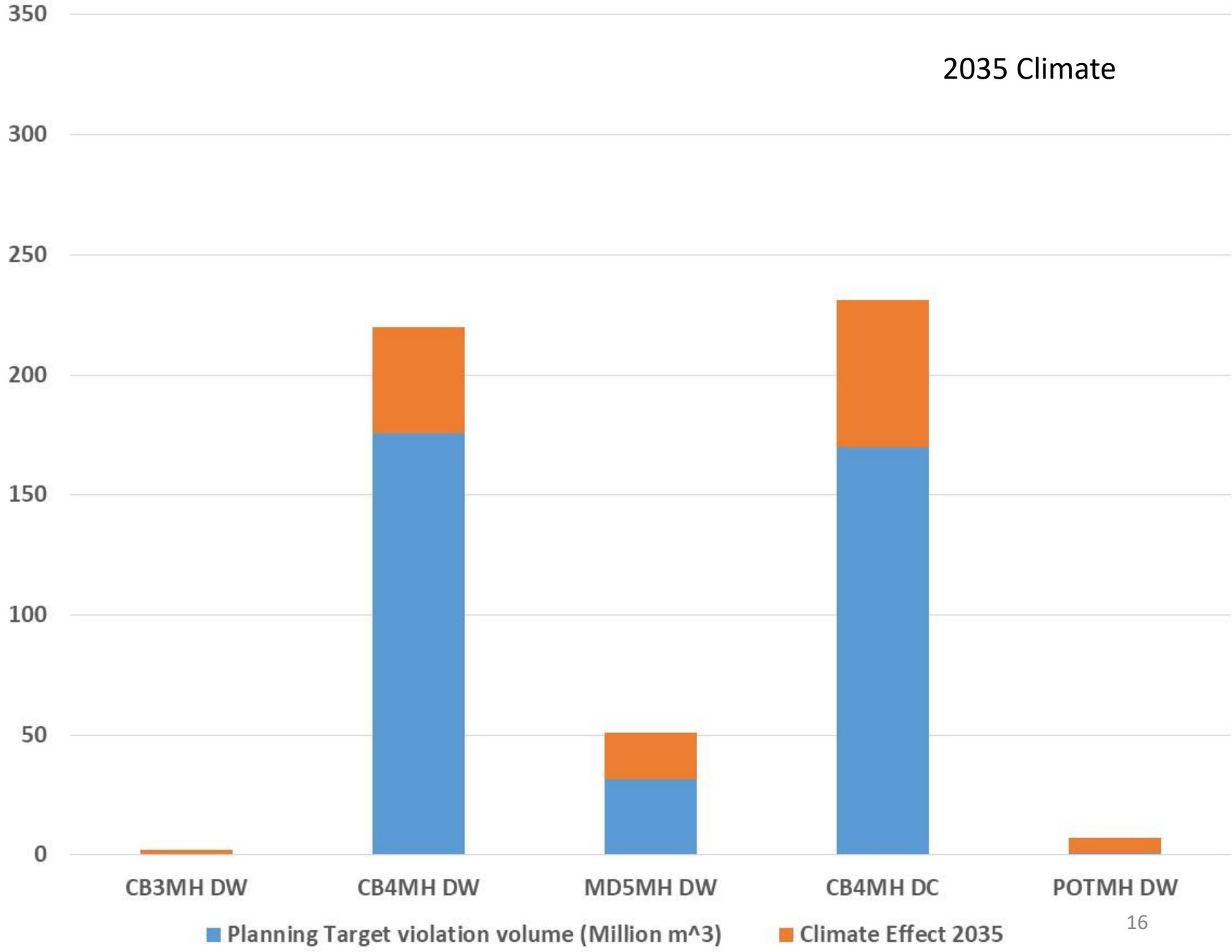
# Additional Reductions for Climate Change

	N	N	P	P
Jurisdiction	December 2017	December 2019	December 2017	December 2019
DC	0.006	0.005	0.001	0.001
DE	0.397	0.337	0.006	0.006
MD	2.194	1.850	0.117	0.097
NY	0.400	0.384	0.015	0.016
PA	4.135	3.652	0.143	0.126
VA	1.722	1.521	0.187	0.168
WV	0.236	0.220	0.017	0.015
BasinWide	9.089	7.970	0.485	0.428

## 2025 Climate



# 2035 Climate

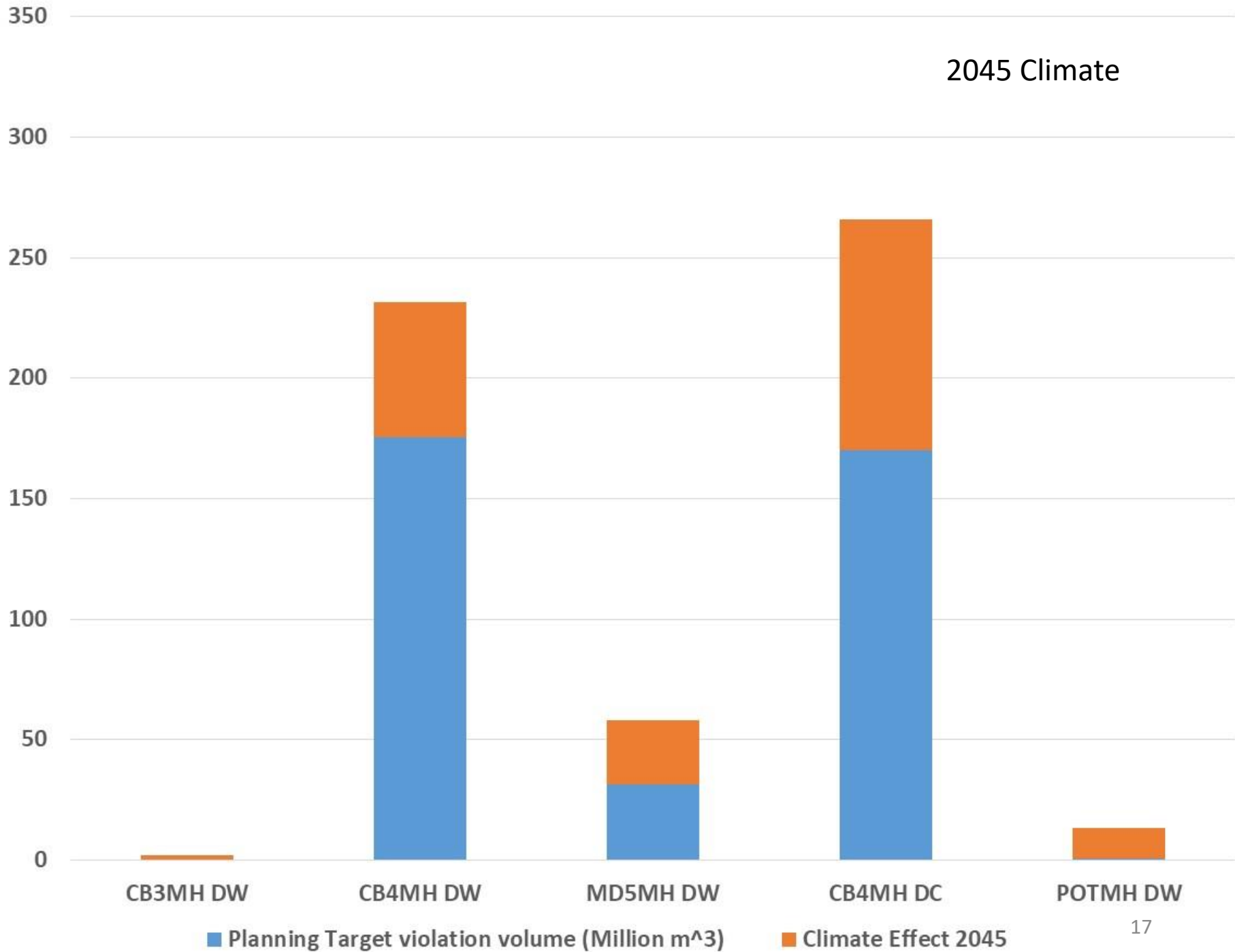


■ Planning Target violation volume (Million m<sup>3</sup>)

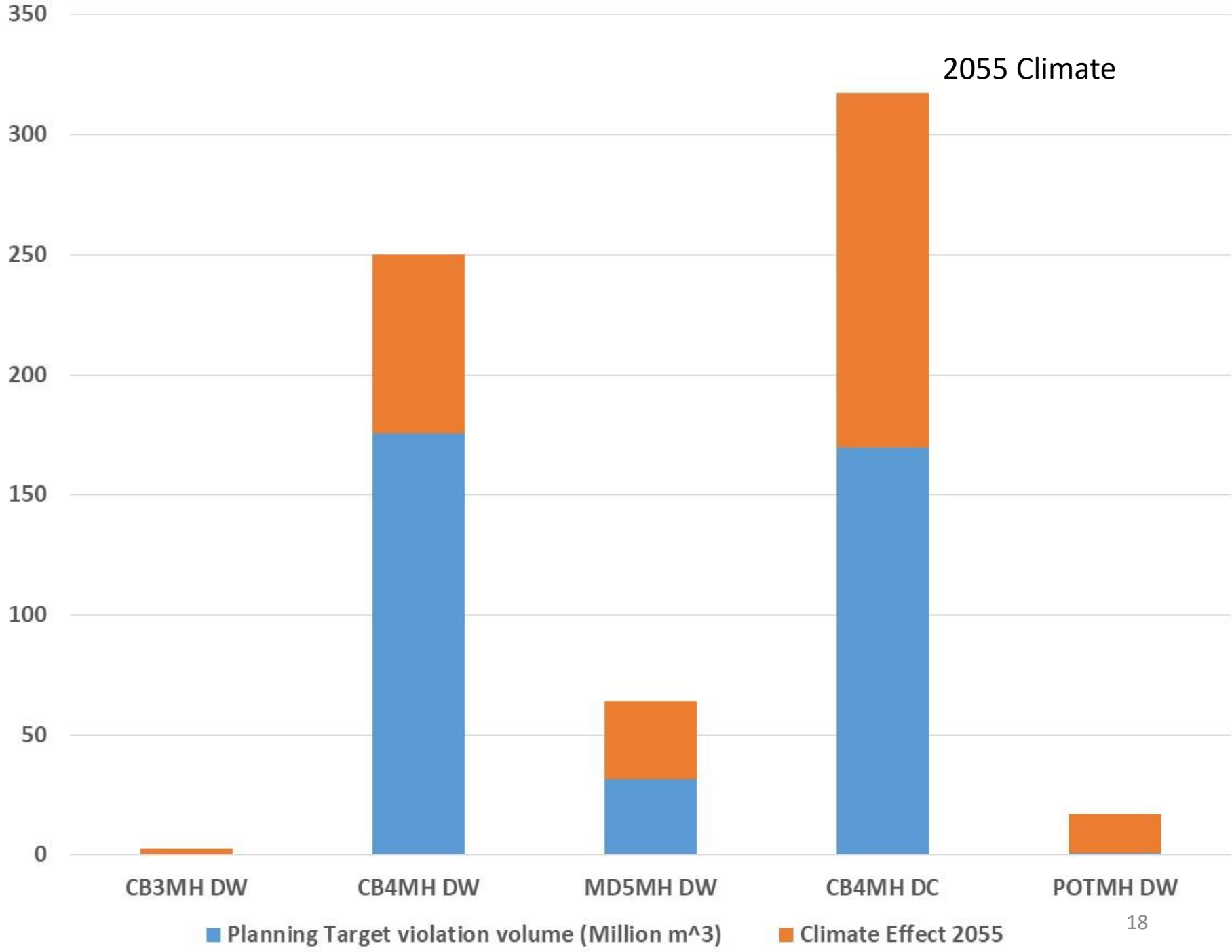
■ Climate Effect 2035



## 2045 Climate

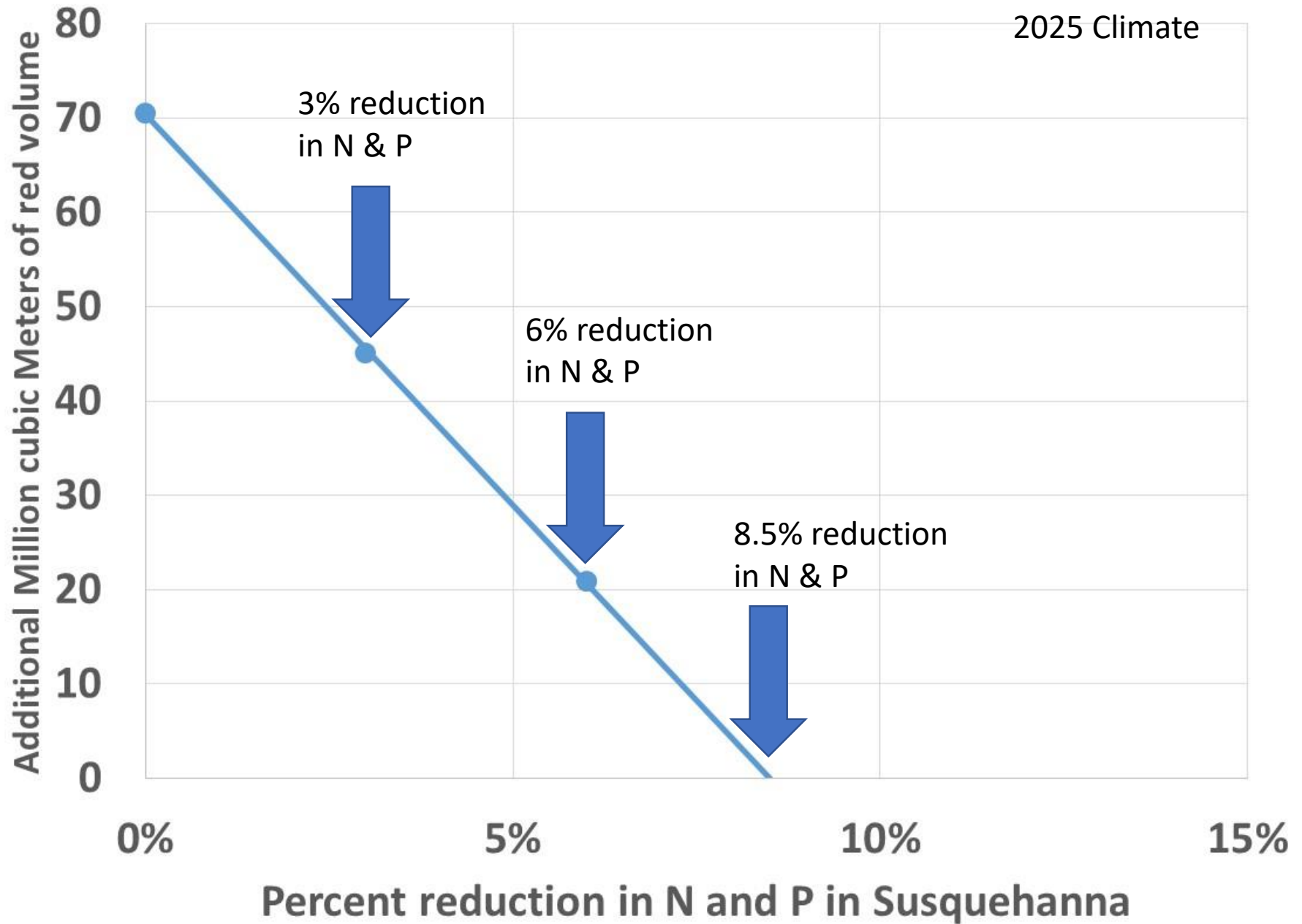


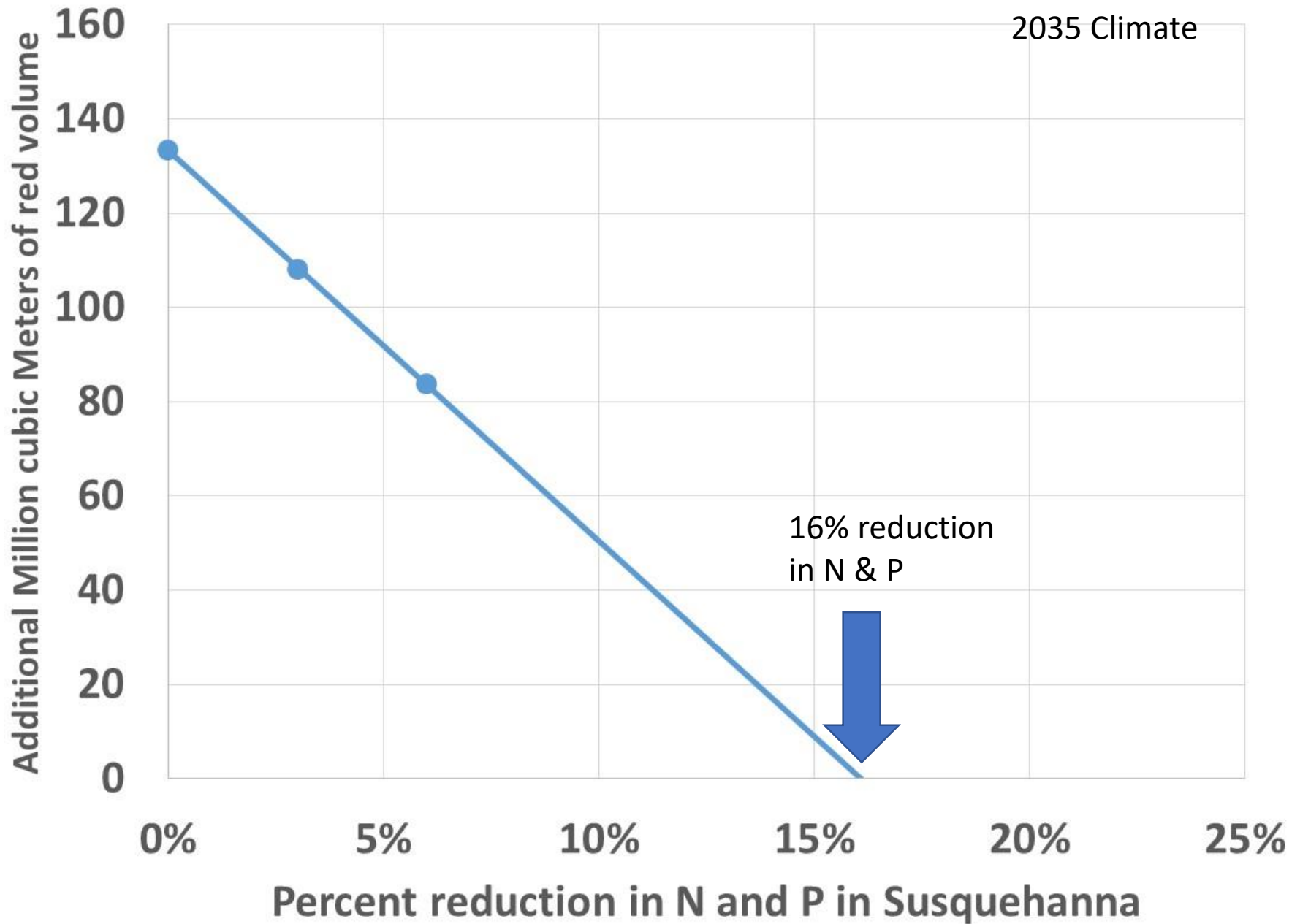
2055 Climate

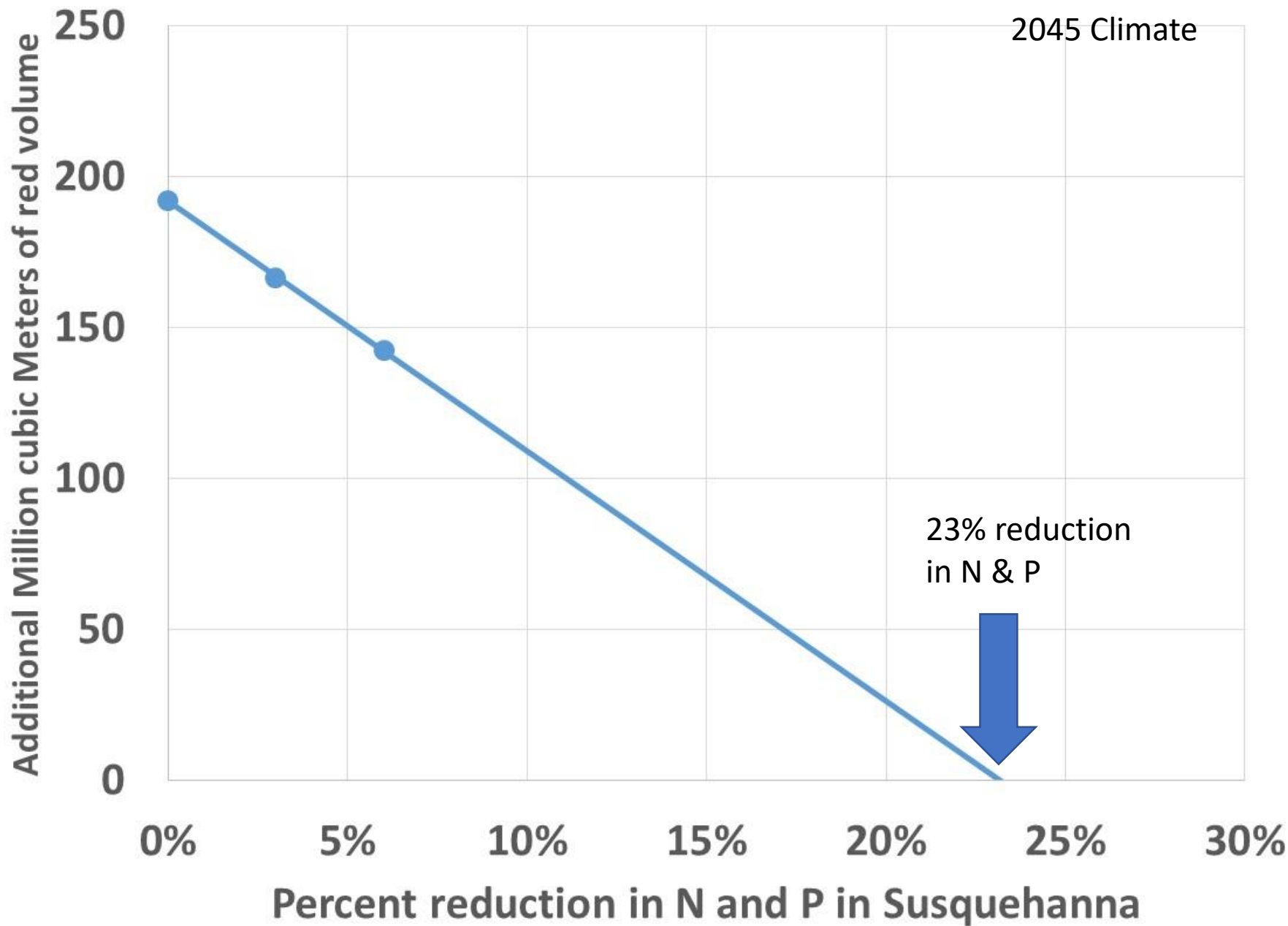


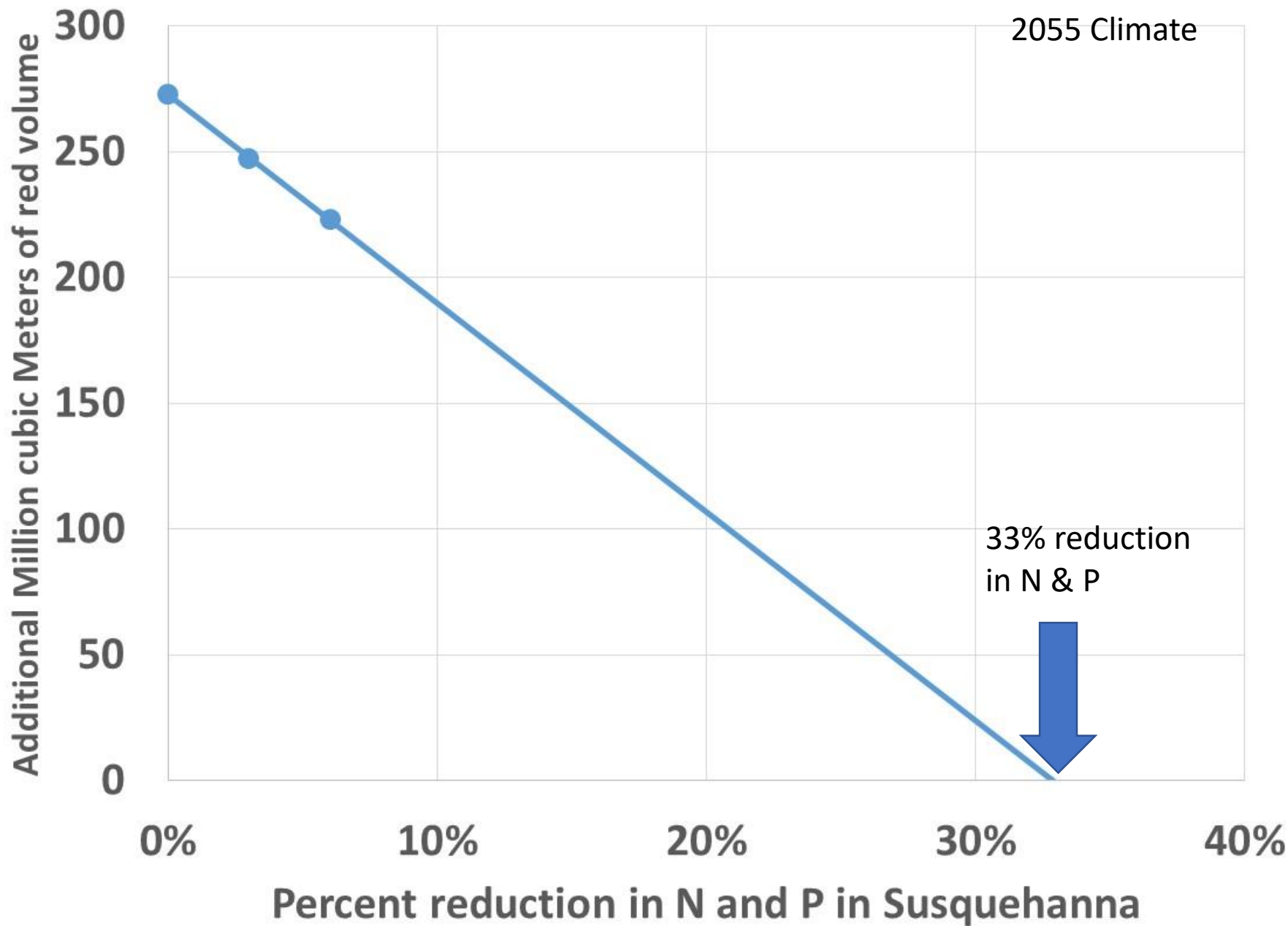
■ Planning Target violation volume (Million m<sup>3</sup>)

■ Climate Effect 2055

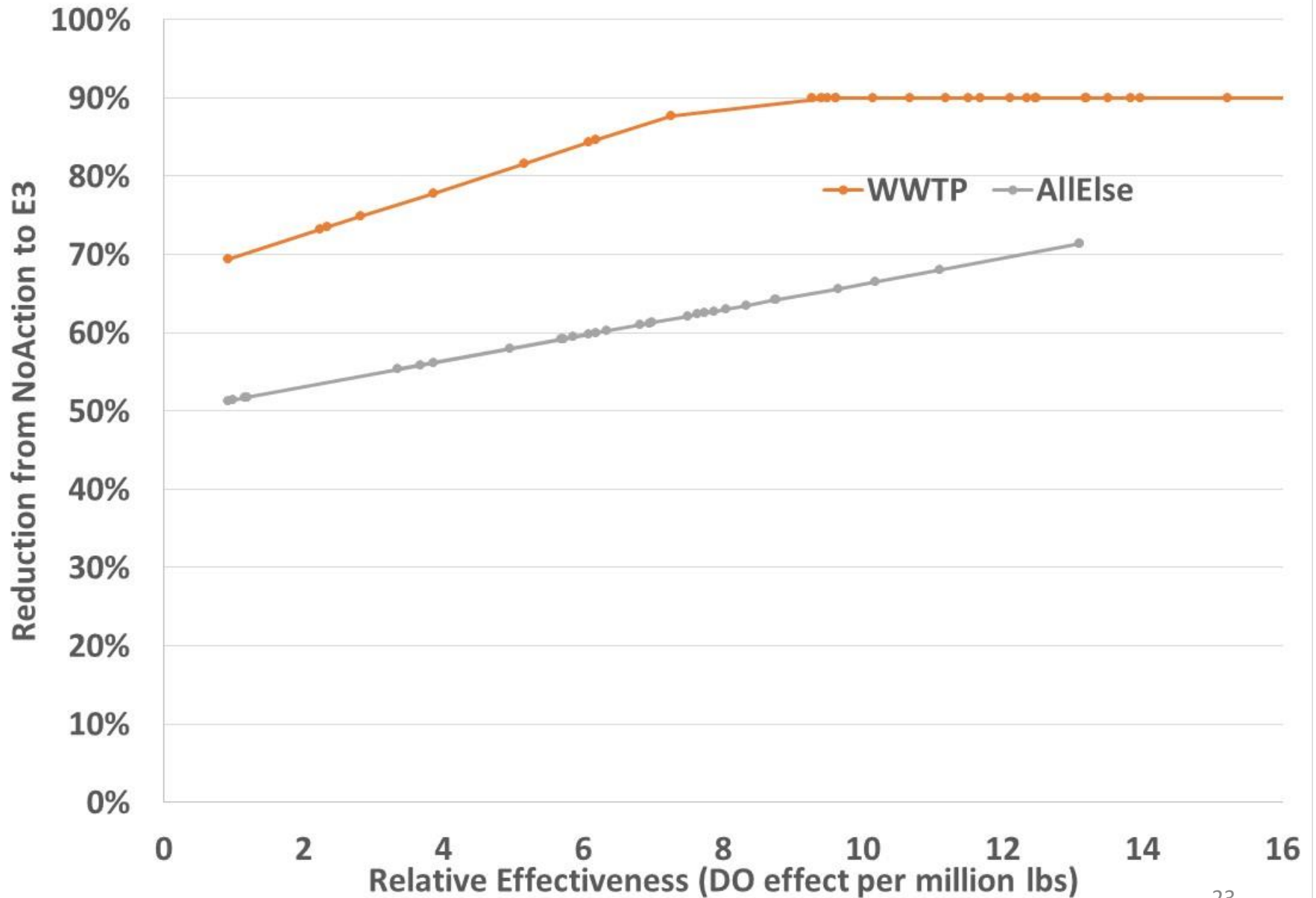




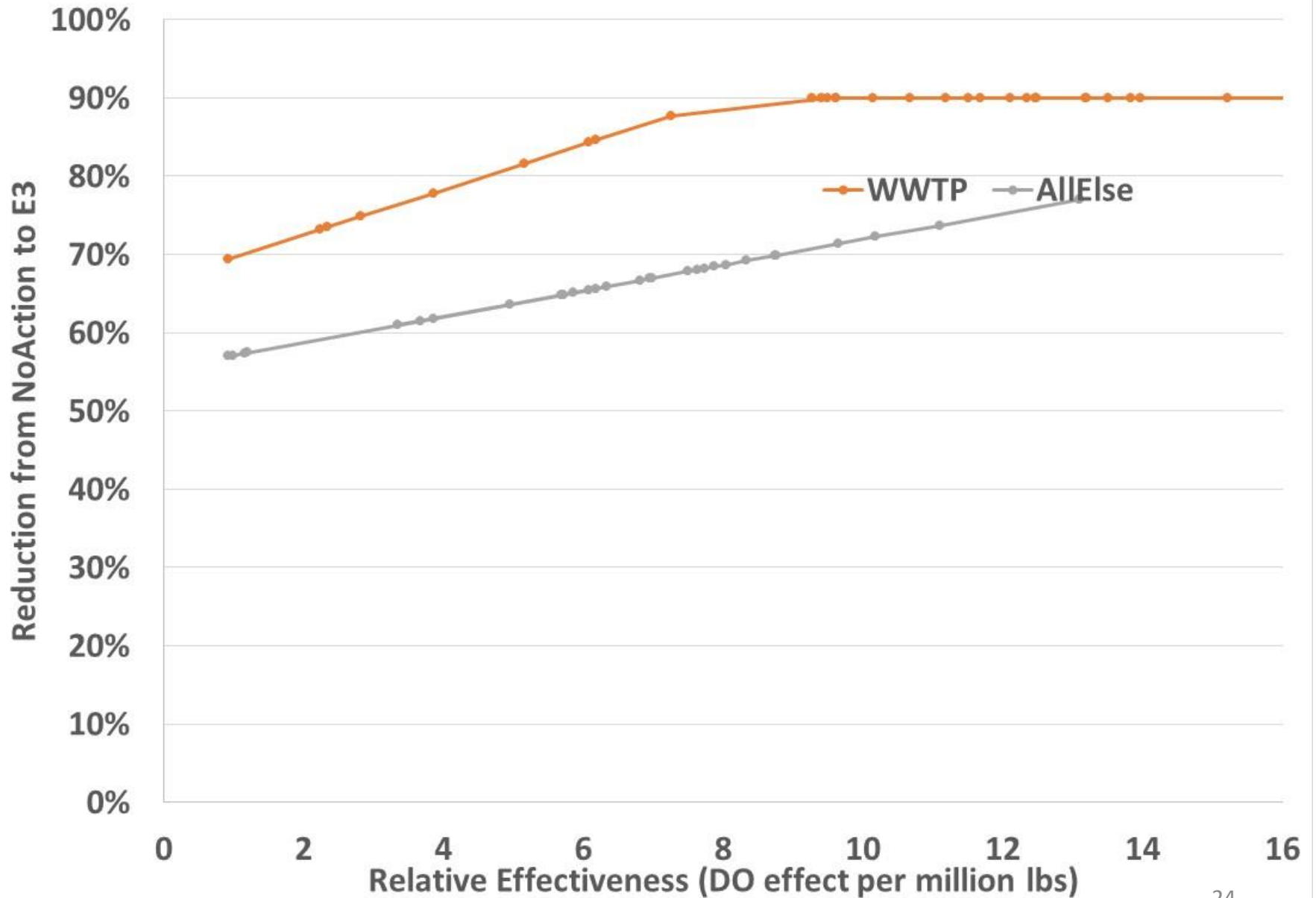




## Planning Target Calculation - Nitrogen

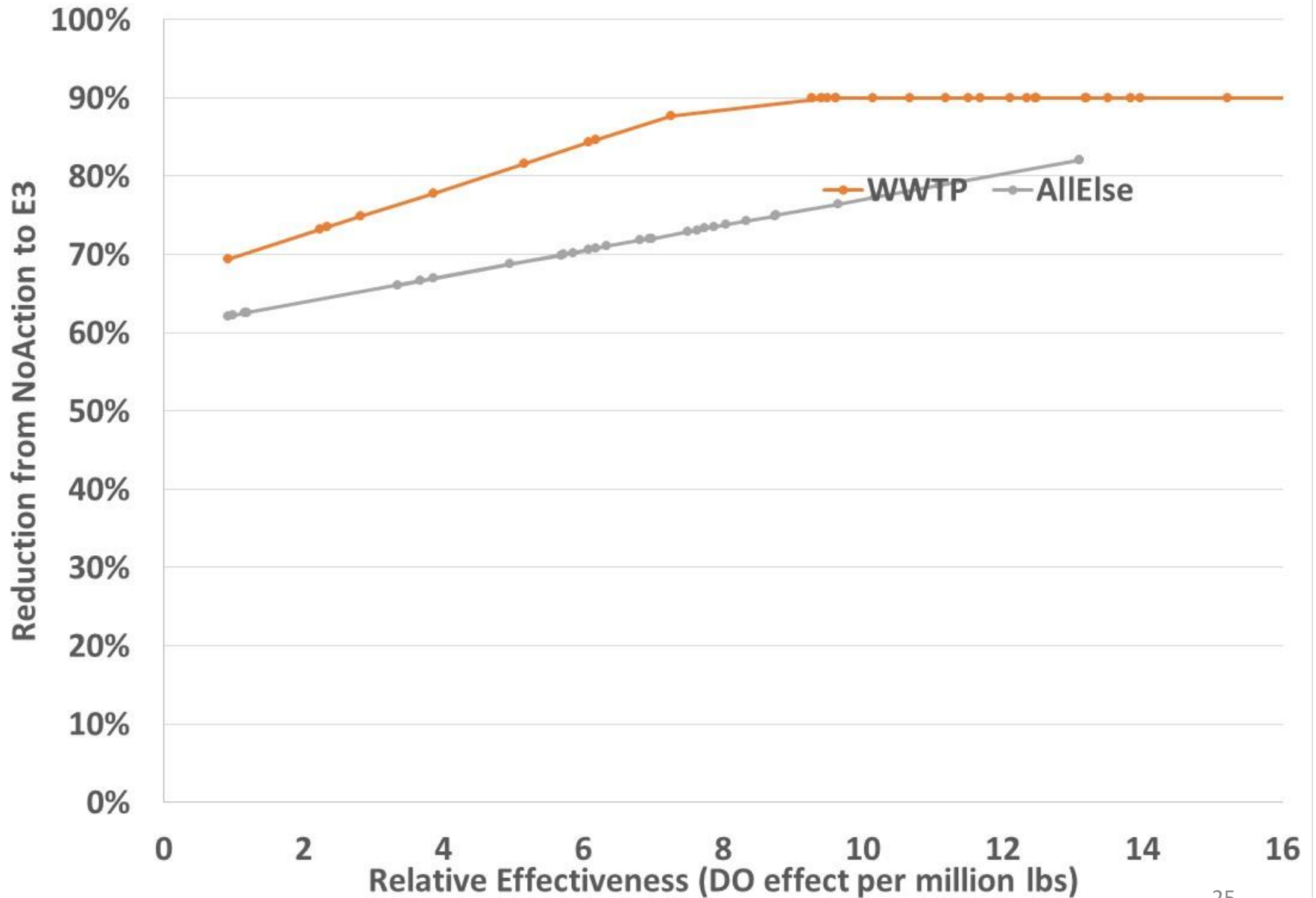


# Planning Target Calculation - Nitrogen 2025 Climate

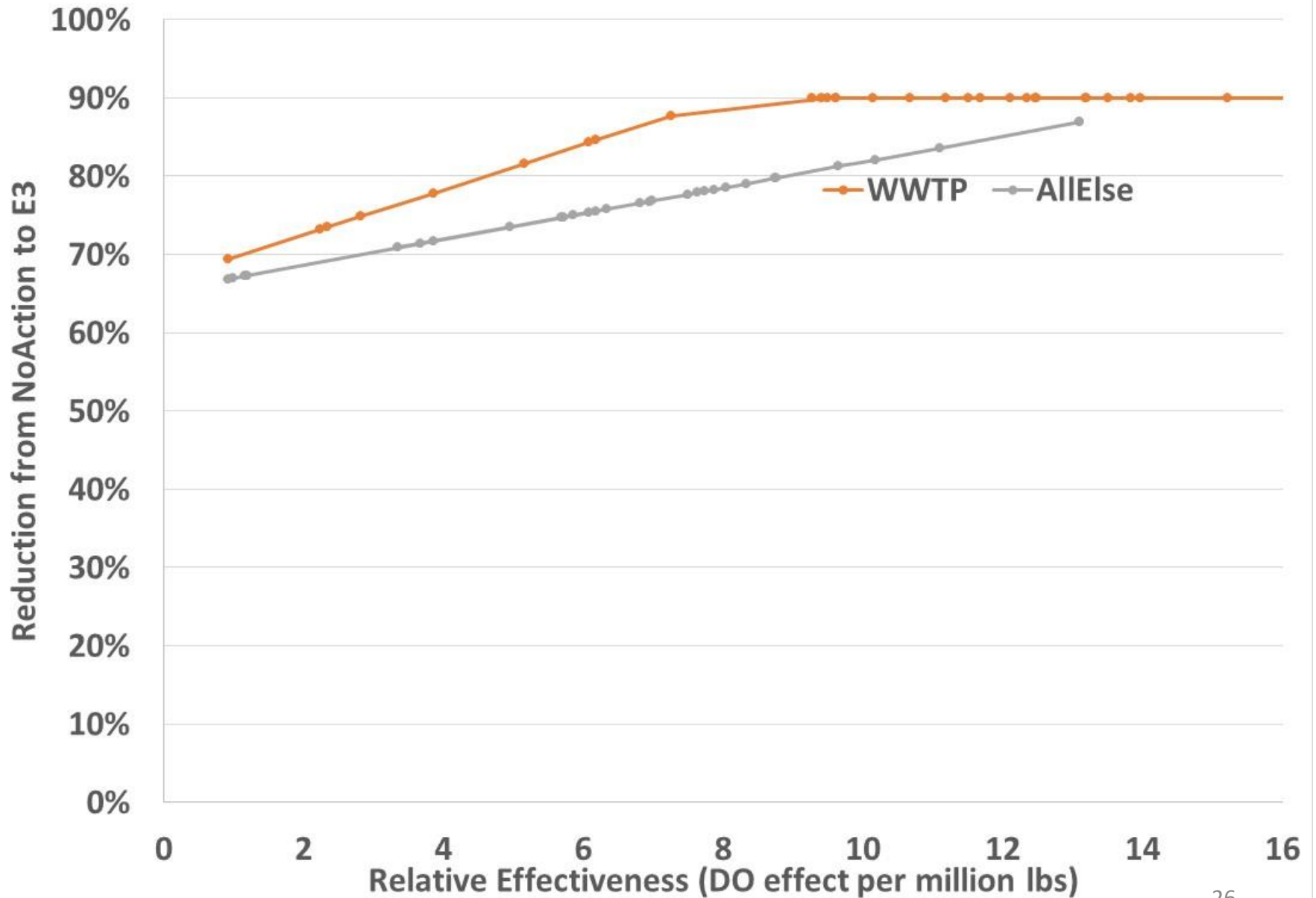




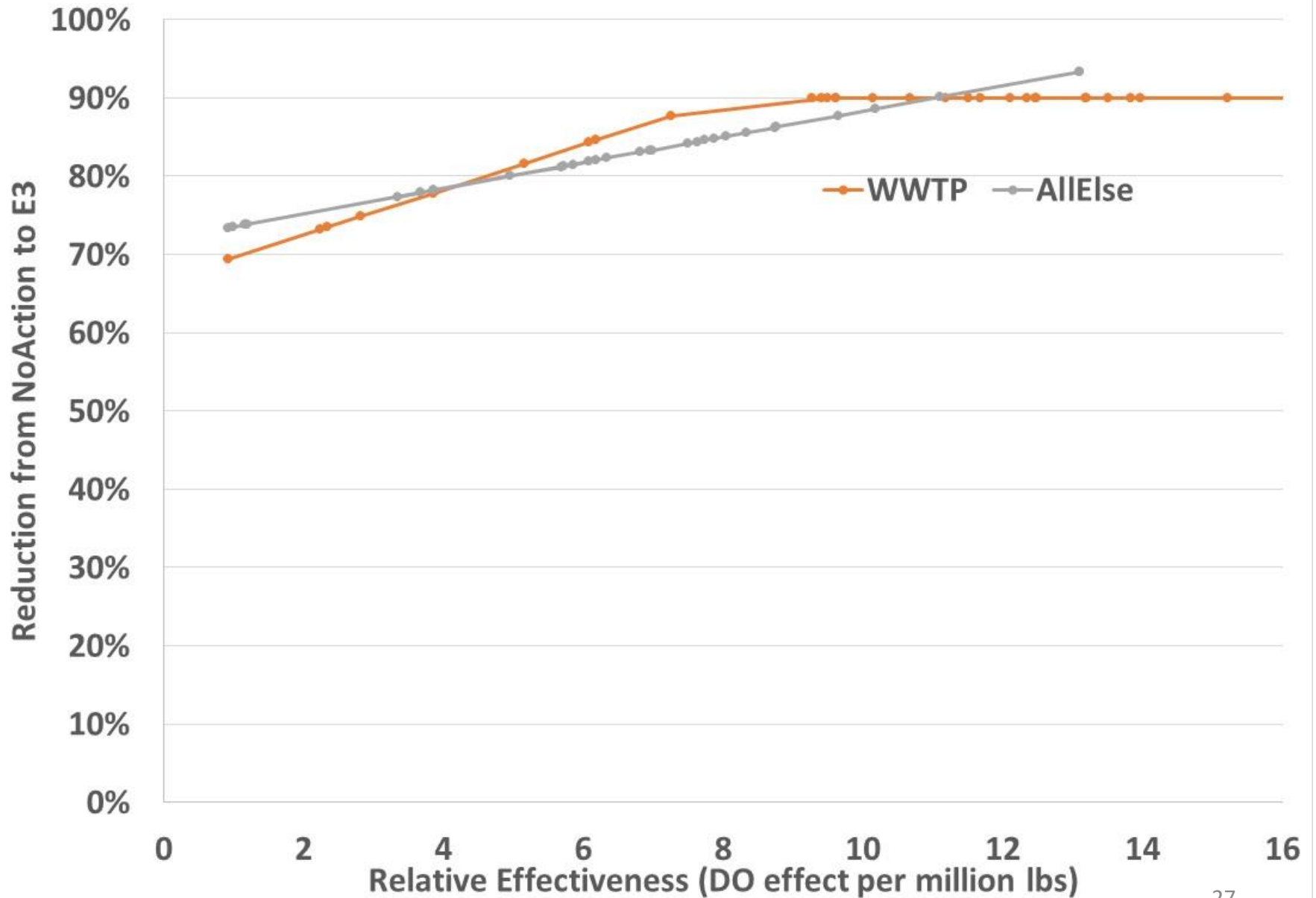
# Planning Target Calculation - Nitrogen 2035 Climate



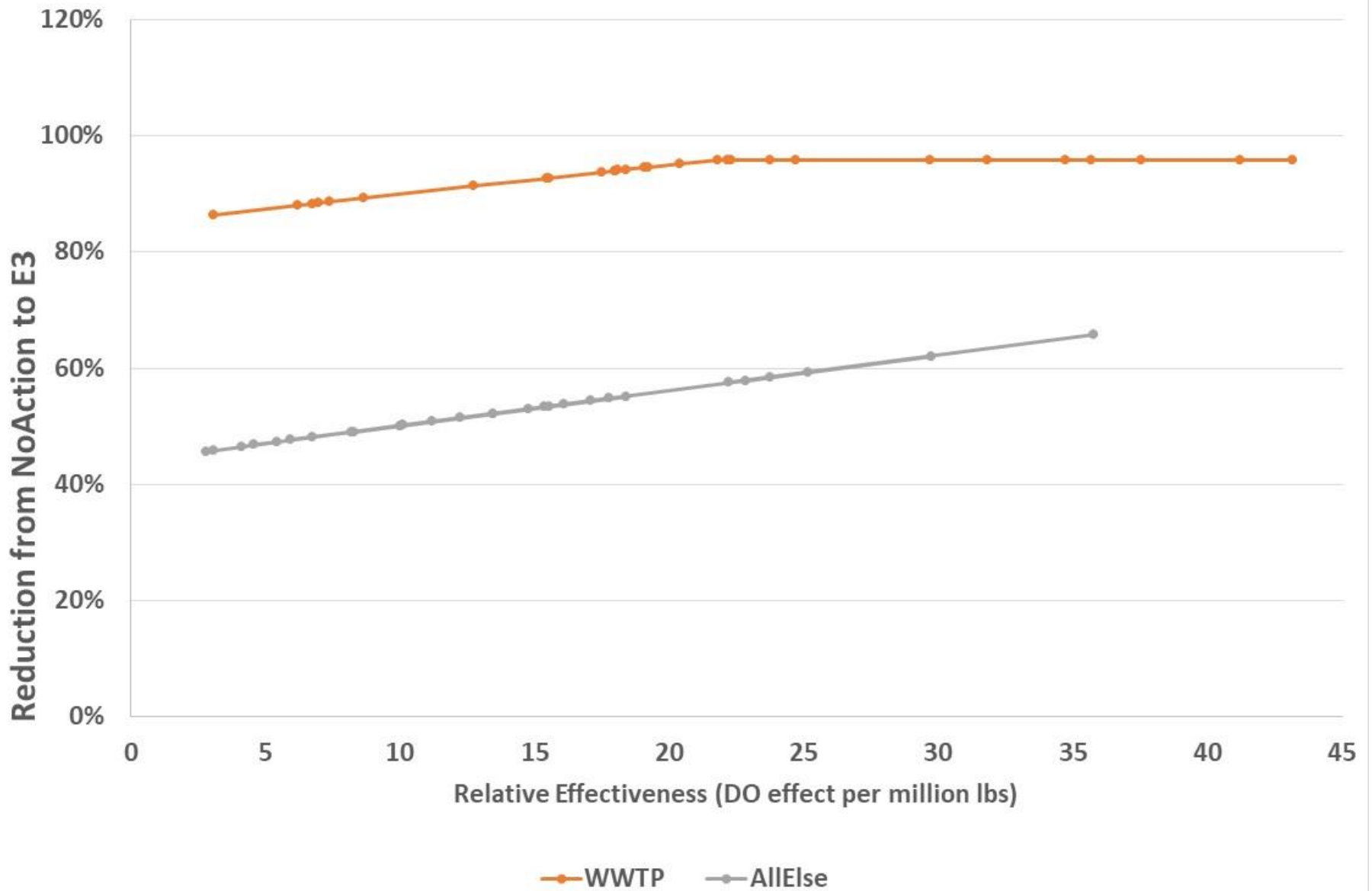
# Planning Target Calculation - Nitrogen 2045 Climate



# Planning Target Calculation - Nitrogen 2055 Climate

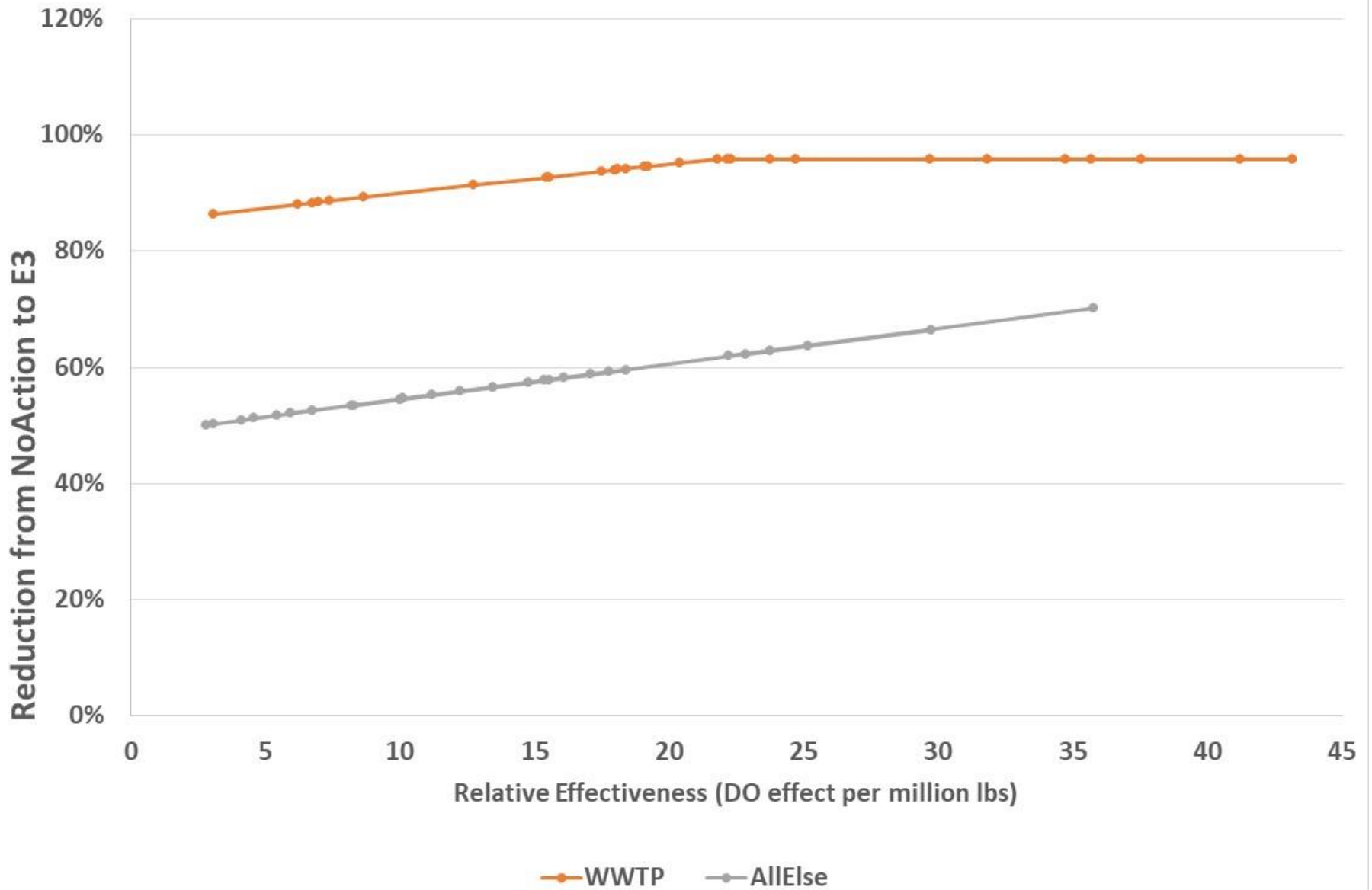


### Planning Target Calculation - Phosphorus



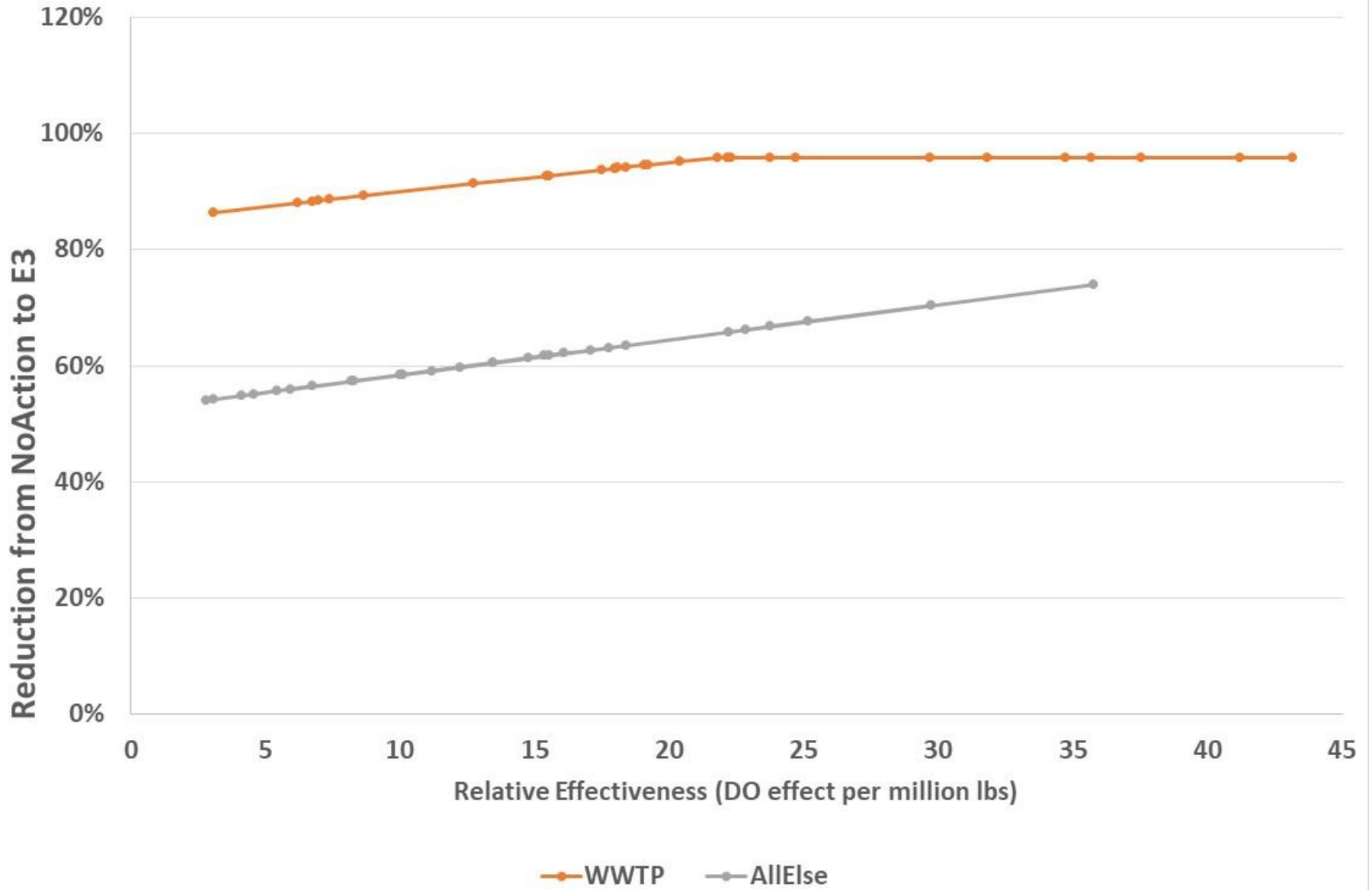
# Planning Target Calculation - Phosphorus

2025 Climate



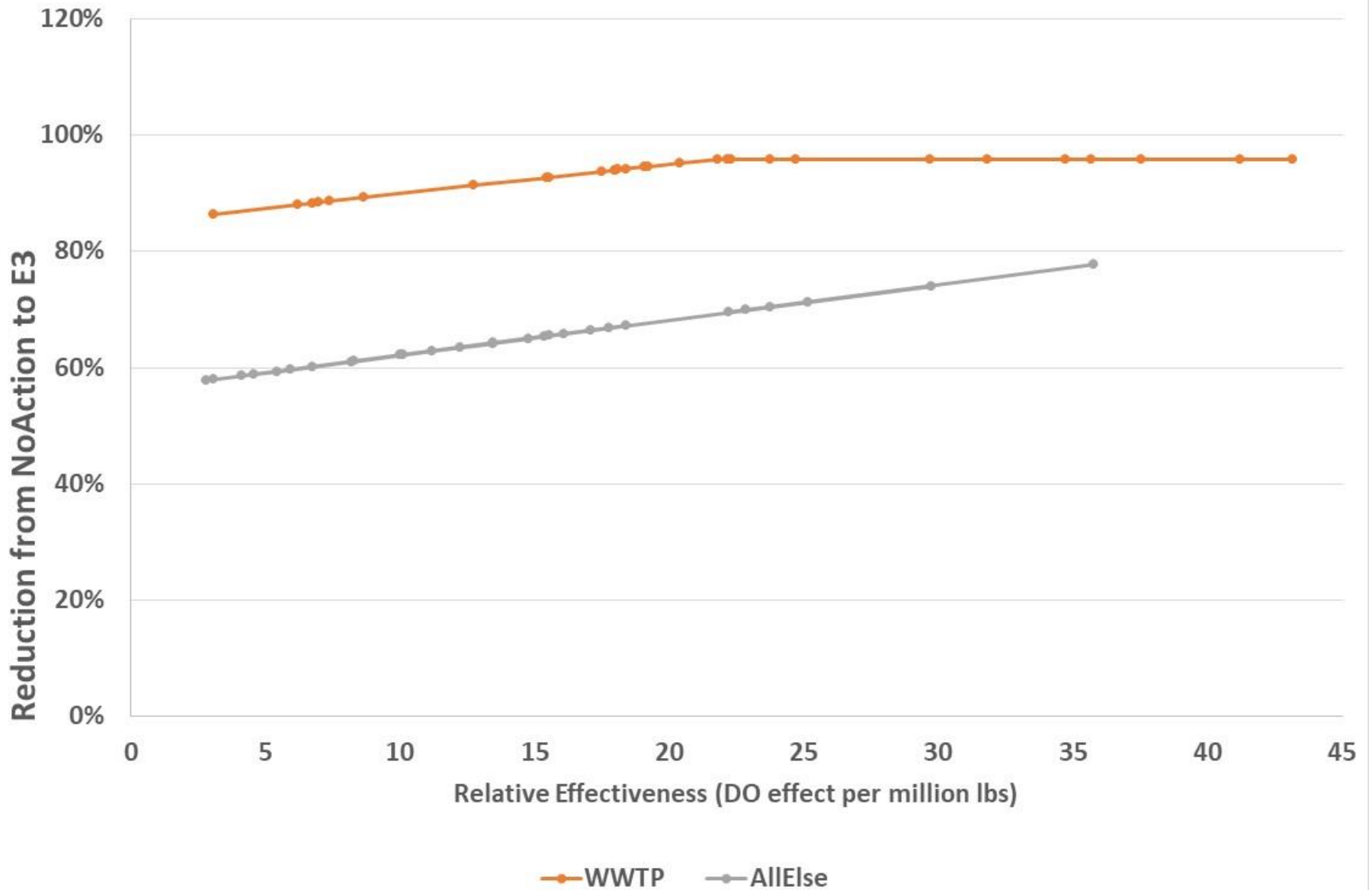
# Planning Target Calculation - Phosphorus

2035 Climate



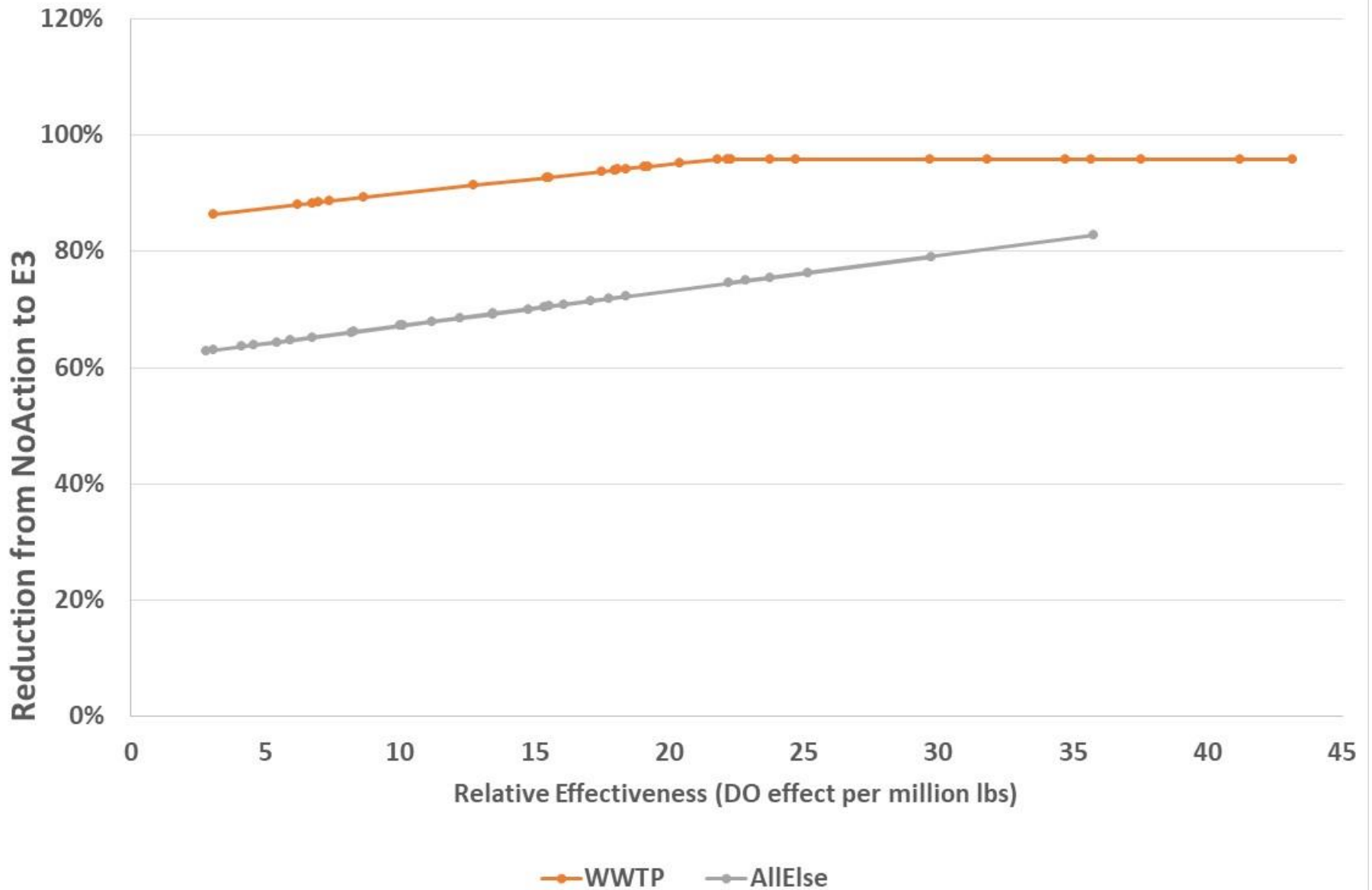
# Planning Target Calculation - Phosphorus

2045 Climate



# Planning Target Calculation - Phosphorus

2055 Climate





# Additional Reductions for Climate Change

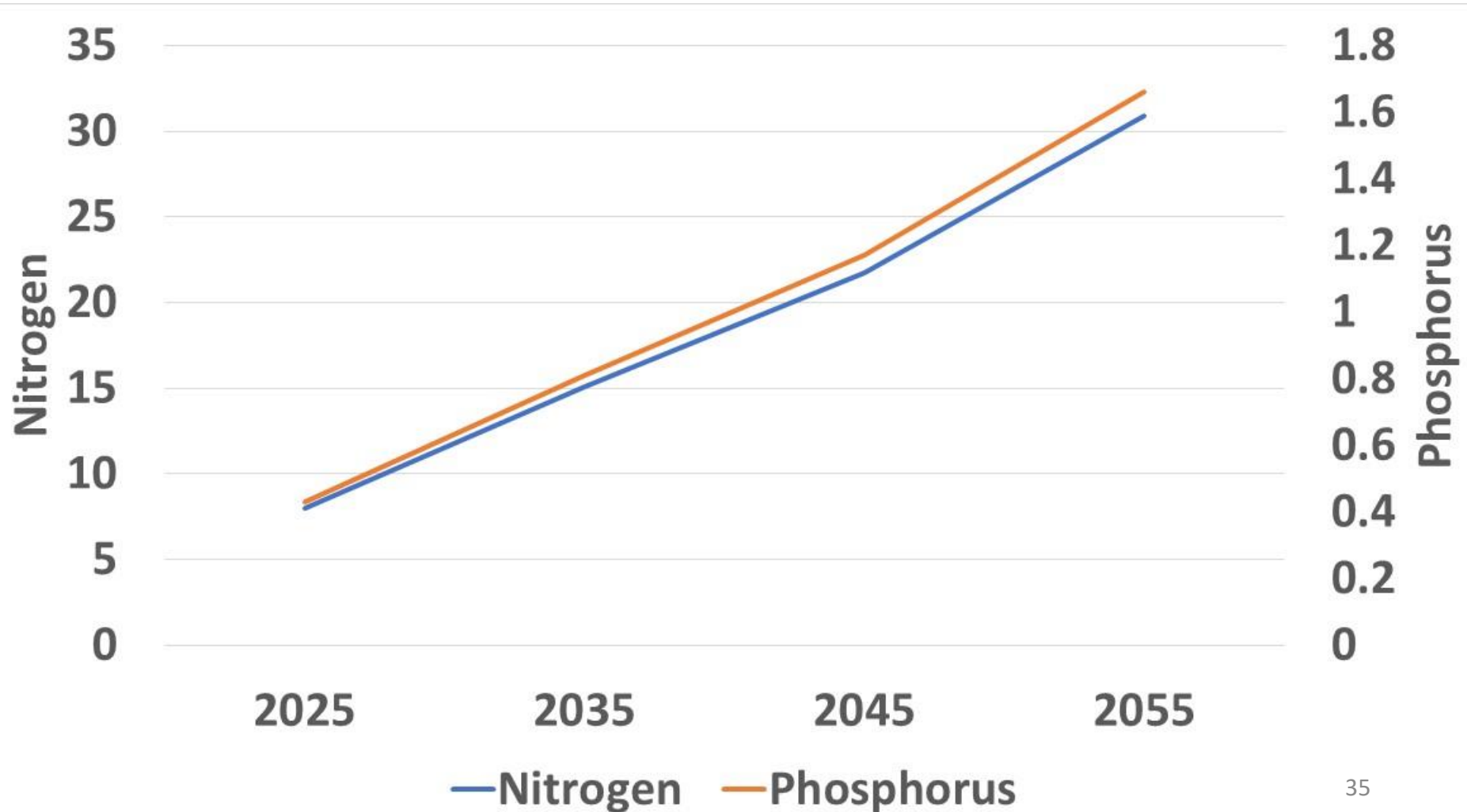
## Nitrogen

Jurisdiction	2025 Climate	2035 Climate	2045 Climate	2055 Climate
DC	0.005	0.010	0.015	0.021
DE	0.337	0.639	0.921	1.307
MD	1.850	3.506	5.051	7.169
NY	0.384	0.728	1.049	1.489
PA	3.652	6.921	9.971	14.152
VA	1.521	2.883	4.153	5.895
WV	0.220	0.416	0.600	0.851
BasinWide	7.970	15.103	21.760	30.883

# Additional Reductions for Climate Change Phosphorus

Jurisdiction	2025 Climate	2035 Climate	2045 Climate	2055 Climate
DC	0.001	0.002	0.003	0.004
DE	0.006	0.011	0.016	0.023
MD	0.097	0.183	0.263	0.374
NY	0.016	0.029	0.042	0.060
PA	0.126	0.239	0.345	0.489
VA	0.168	0.319	0.459	0.652
WV	0.015	0.028	0.041	0.058
BasinWide	0.428	0.812	1.169	1.660

# Reductions for climate change



# Additional Reductions for Climate Change

	N	N	P	P
Jurisdiction	December 2017	December 2019	December 2017	December 2019
DC	0.006	0.005	0.001	0.001
DE	0.397	0.337	0.006	0.006
MD	2.194	1.850	0.117	0.097
NY	0.400	0.384	0.015	0.016
PA	4.135	3.652	0.143	0.126
VA	1.722	1.521	0.187	0.168
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