IFA Long-Term Fertilizer Demand Scenarios

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Background

- ✓ Follow up to IFA2030
- ✓ Initiative approved by the Board of Directors

Objective

- ✓ Considering the implications of alternative agriculture, nutrient use efficiency and manure recycling futures on the outlook for fertilizer demand to 2030 and 2050

How

- ✓ Combination of agricultural futures (based on FAO's projections) and nutrient management futures (developed by IFA)

Methodology

Scope of the Study and Assumptions

Scope of the Study

- ✓ **Limited to fertilizer application to crops**
  - → Excludes fertilizer applications to grassland, forestry, ornamentals, turf, etc.
  - → Excludes feed and industrial uses

Key assumptions

- ✓ **Plant nutrient management for crop production will improve over time**, whether it is crop nutrient use efficiency (NUE), manure recycling, or livestock feeding, with the exception of the low efficiency scenario
- ✓ **Manure use efficiency < fertilizer use efficiency**
- ✓ **No disruptive agricultural technology**
  - → Excludes potential shift e.g. to artificial meat or milk
- ✓ **Incremental improvement for crop NUE and manure management**
  - → Excludes potential for disruptive technological breakthrough

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General Methodology Used

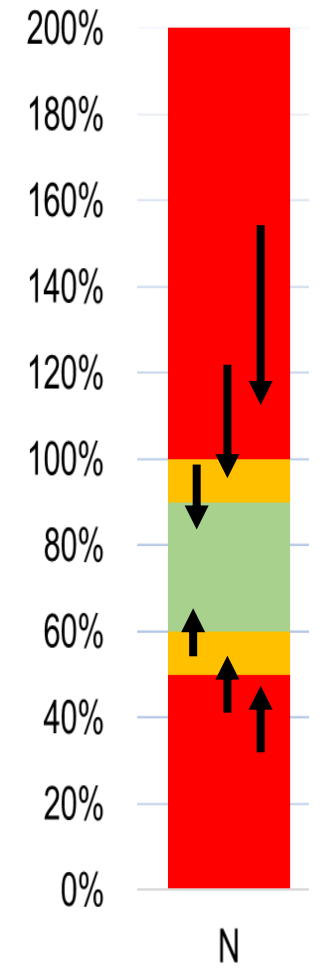
Agricultural futures

- FAO's BAU scenario + modulations (+10% and -10%)
- IFA's composite scenario combining FAO's BAU and TSS scenarios

Nutrient management futures
(use efficiency + manure recycling)

- Red/orange/green zones that:
  - Are nutrient-specific
  - Reflect soil types and legacy of previous applications (for P and K)
- Reduction of the "NUE gap" over time
- Reduction of the "recycling gap" over time
- Manure reduction factor
- 4 scenarios:
  - No change
  - Medium-ambition improvement
  - High-ambition improvement
  - Customized ambition

Illustration of the NUE Target



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Focus on 4 Plausible IFA Scenarios
(agriculture futures x nutrient management futures)

IFA Scenario	Agricultural Future	Nutrient Management Future
LOW EFFICIENCY	Business as Usual (BAU) +10%	No change
MEDIUM EFFICIENCY	BAU	Medium Ambition
HIGH EFFICIENCY	BAU -10%	High Ambition
CUSTOMIZED	Mix of BAU, Towards Sustainability (TSS) and average BAU/TSS	Customized by country

- ***BAU (Business As Usual)**: Despite the efforts of many countries, several outstanding challenges facing food and agriculture are left unaddressed.*
- ***TSS (Towards Sustainability Scenario)**: Proactive changes towards more sustainable food and agricultural systems.*
- ***SSS (Stratified Societies Scenario)**: A future with exacerbated inequalities across countries and throughout different layers of societies.*

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IFA's Customized Scenario

Customized Agricultural Scenario + Customized Nutrient Management Scenario

	BAU	Average BAU-TSS	TSS
WCE*			X
EECA	X		
Africa	X		
North Am		X	
Latin Am		X	
West Asia		X	
South Asia	X		
East Asia		X	
Oceania		X	

(*) TSS for EU countries and BAU-TSS for non-EU countries

	No Change	Medium Ambition	High Ambition
WCE			X
EECA		X	
Africa			X
North Am			X
Latin Am		X	
West Asia		X	
South Asia		X	
East Asia			X
Oceania			X

Special scenarios for China, India and the EU

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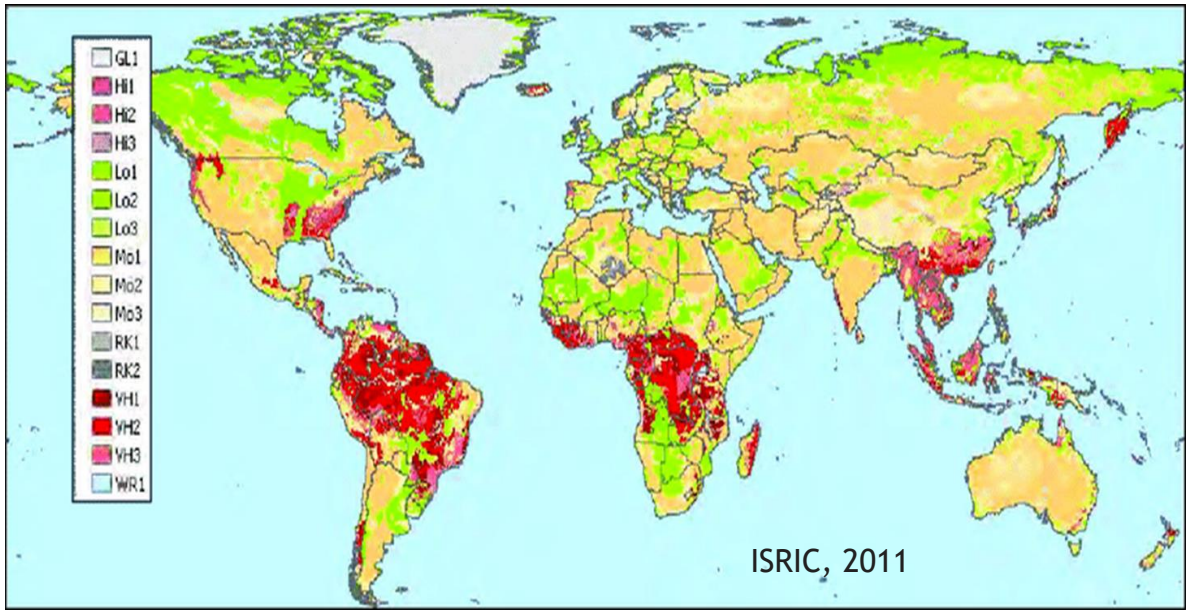
P Demand: Adjustments to the General Methodology

Need to consider:

- ✓ P fixing soils
- ✓ Legacy of previous applications

Global map of soil P retention potential



Additional factors introduced in the methodology

- ✓ P retention potential of soils
  → *P soil factor where prevalence of P-fixing soils is high*
- ✓ Legacy of previous applications (based on IFA's NUE dataset)
  → *P legacy factor in case of long deficit or surplus*
- ✓ Legacy taken into account only if P retention potential is low or moderate; ignored if P retention potential is high or very high

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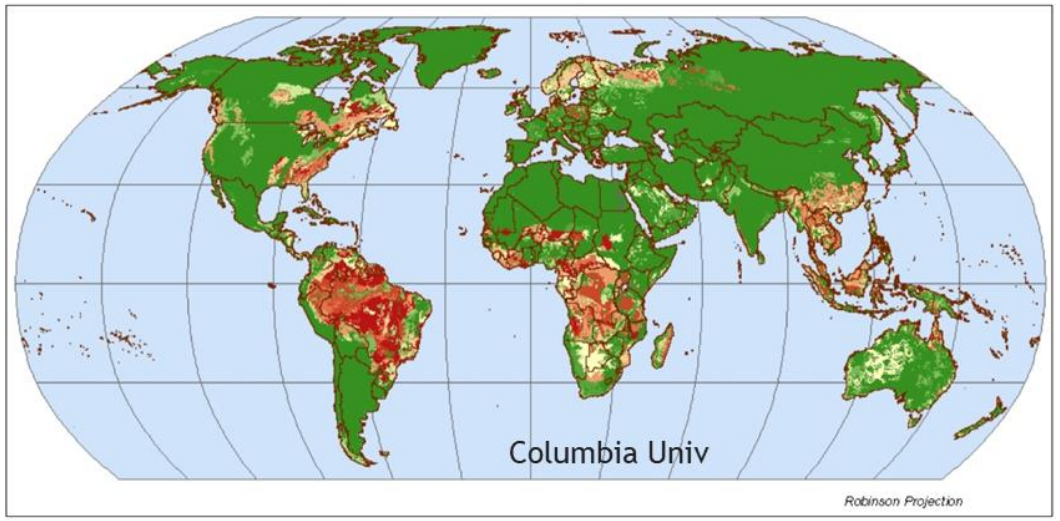
K Demand: Adjustments to the General Methodology

Need to consider:

- ✓ K capital of soils (somewhat related to leaching losses)
- ✓ Legacy of previous applications

Global map of soil K capital reserves



Additional factors introduced in the methodology

- ✓ K capital of soils
  → *K soil factor where prevalence of low-K soils is high*
- ✓ Legacy of previous applications (based on IFA's NUE dataset)
  → *K legacy factor in case of long deficit or surplus*
- ✓ Legacy taken into account only if K capital is high or very high; ignored if K capital is low or moderate

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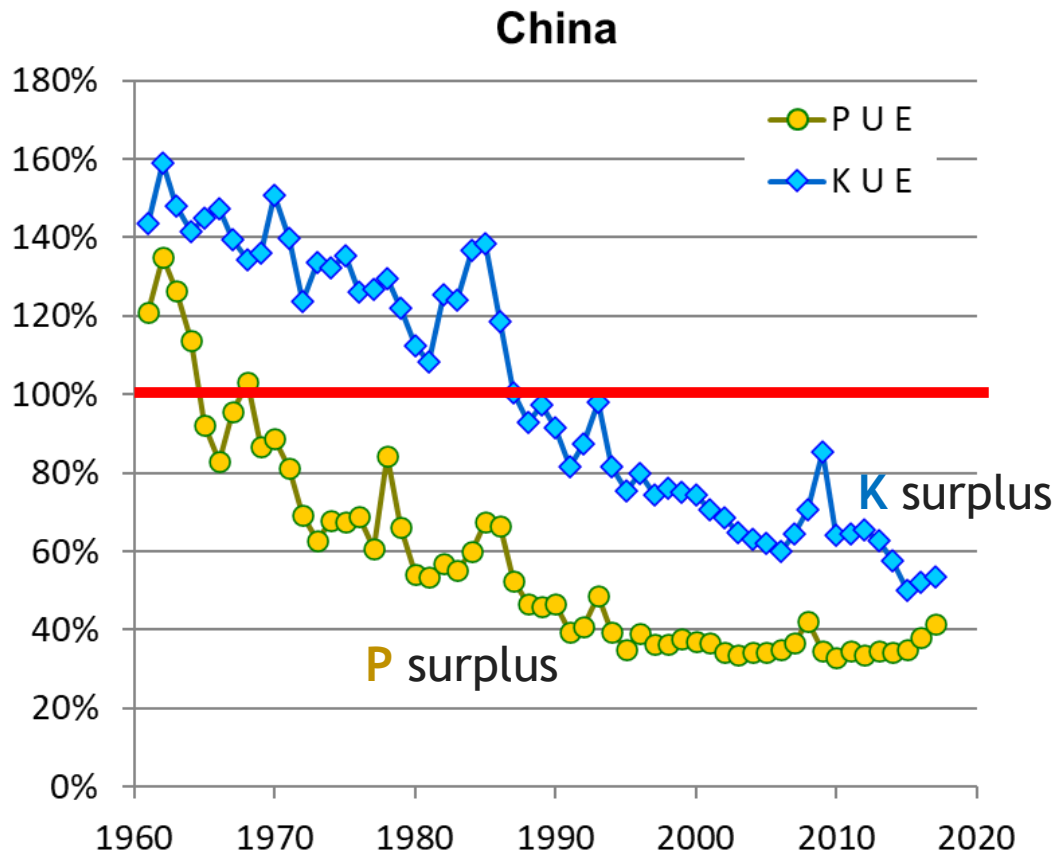
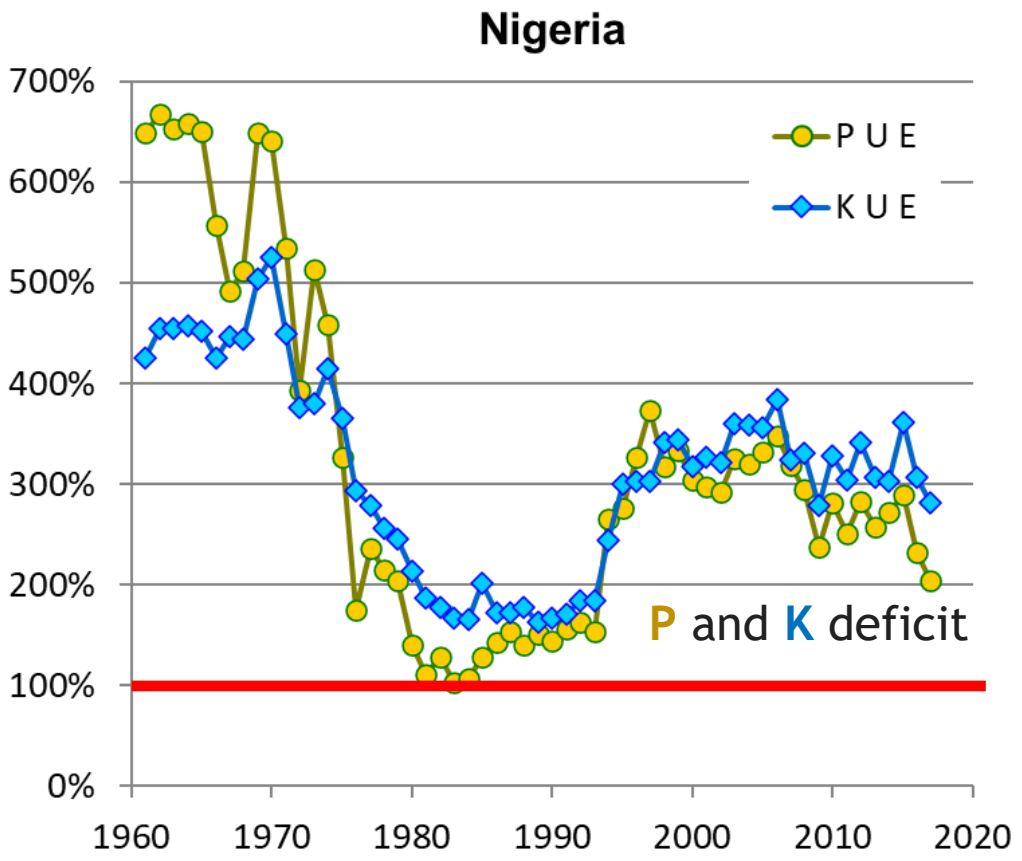
Legacy of Previous Applications

Example of country with a long history of P and K surplus



Example of country with a long history of P and K deficit



Source: based on IFA's nutrient use efficiency dataset (2020)

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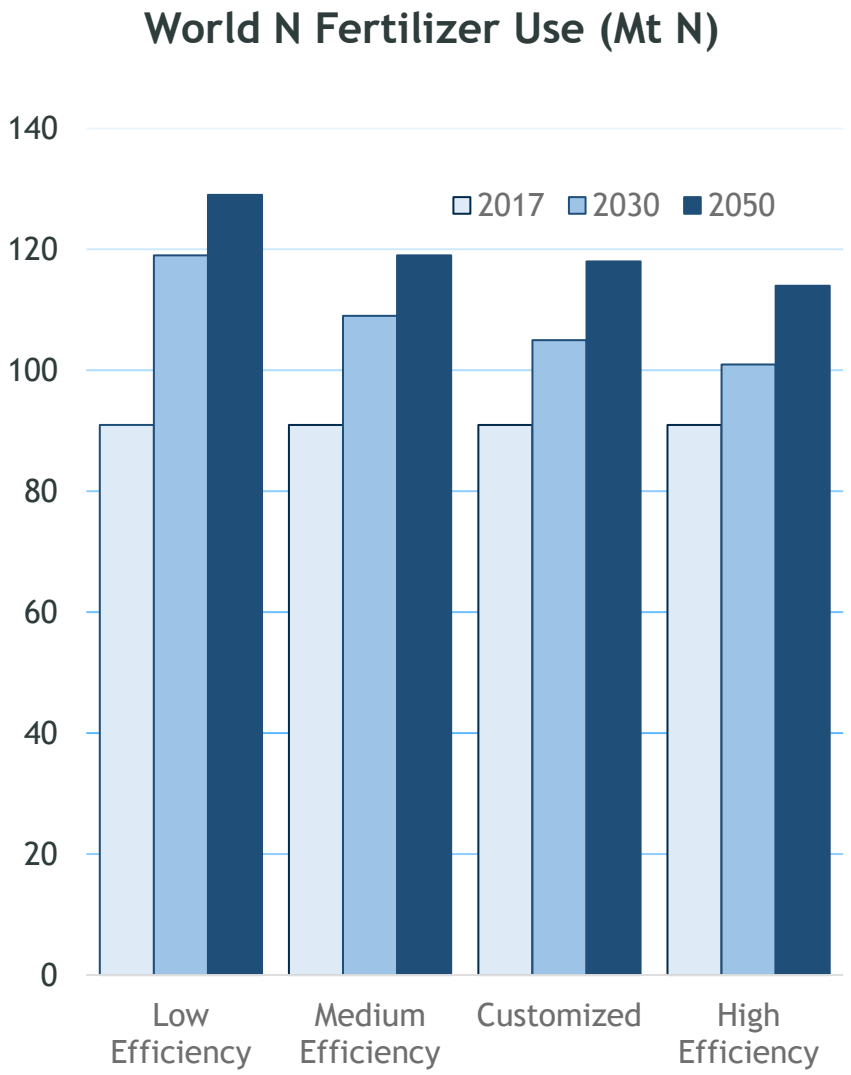
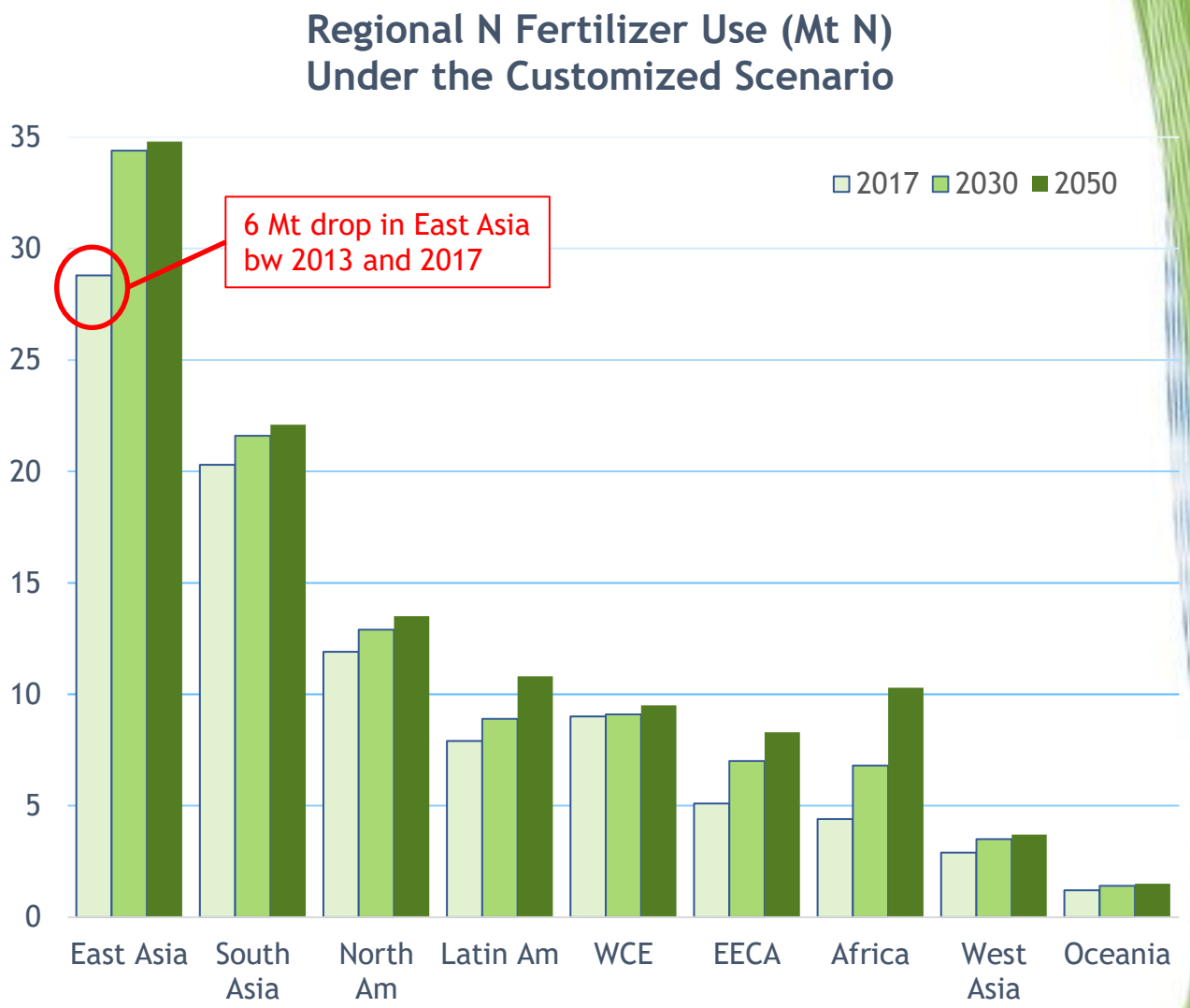
Projections for Fertilizer Applications to Cropland

World and Regional N Fertilizer Use Projections





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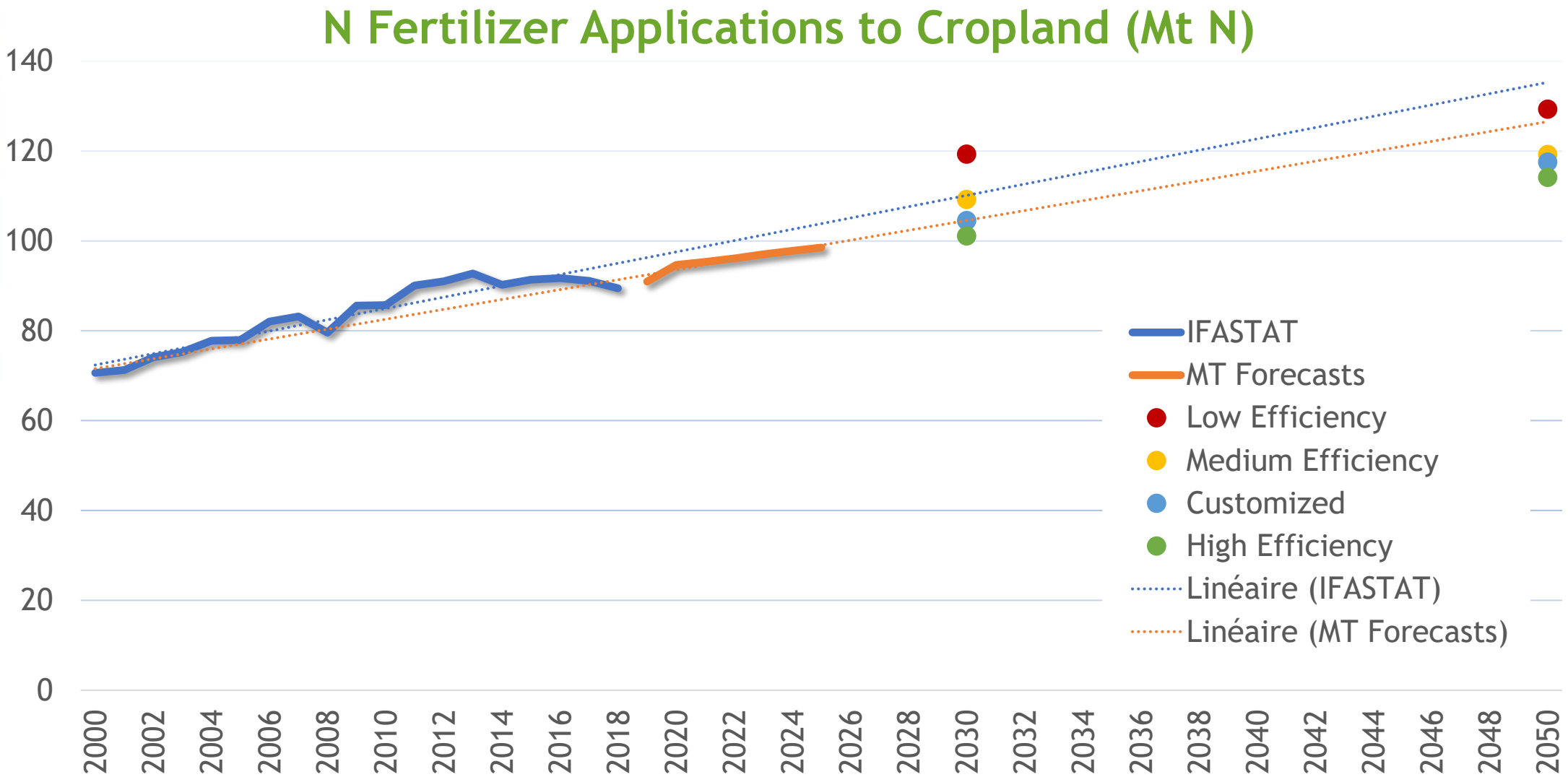
How Do the Projections Compare with the Recent Past?



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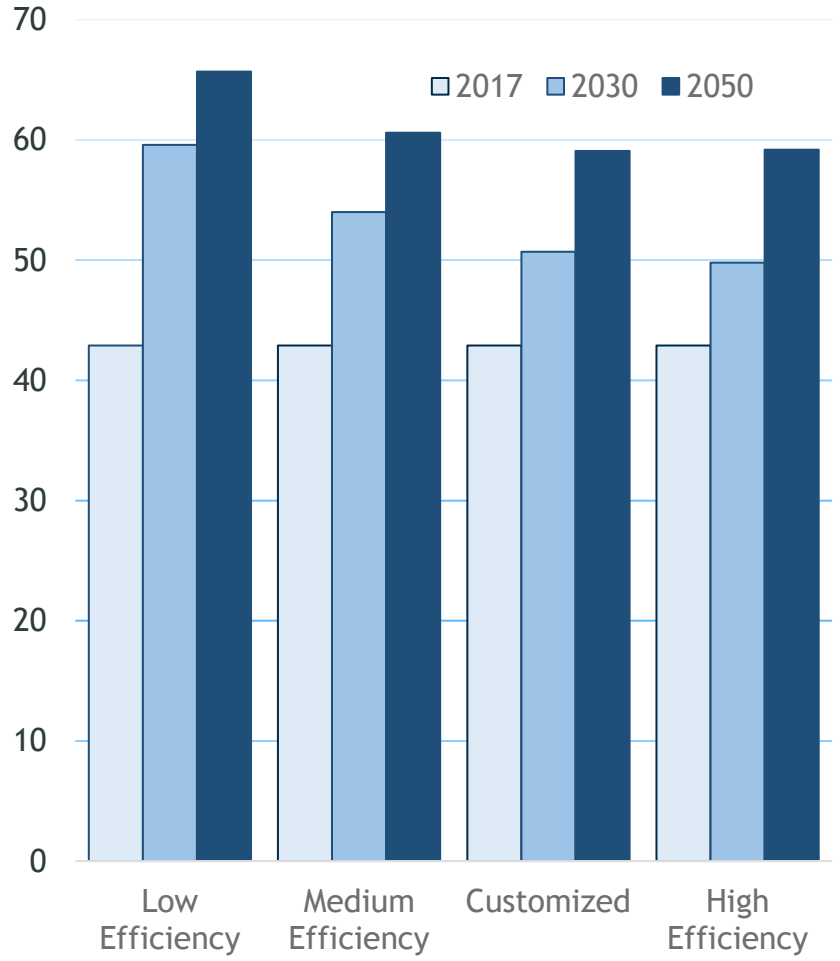
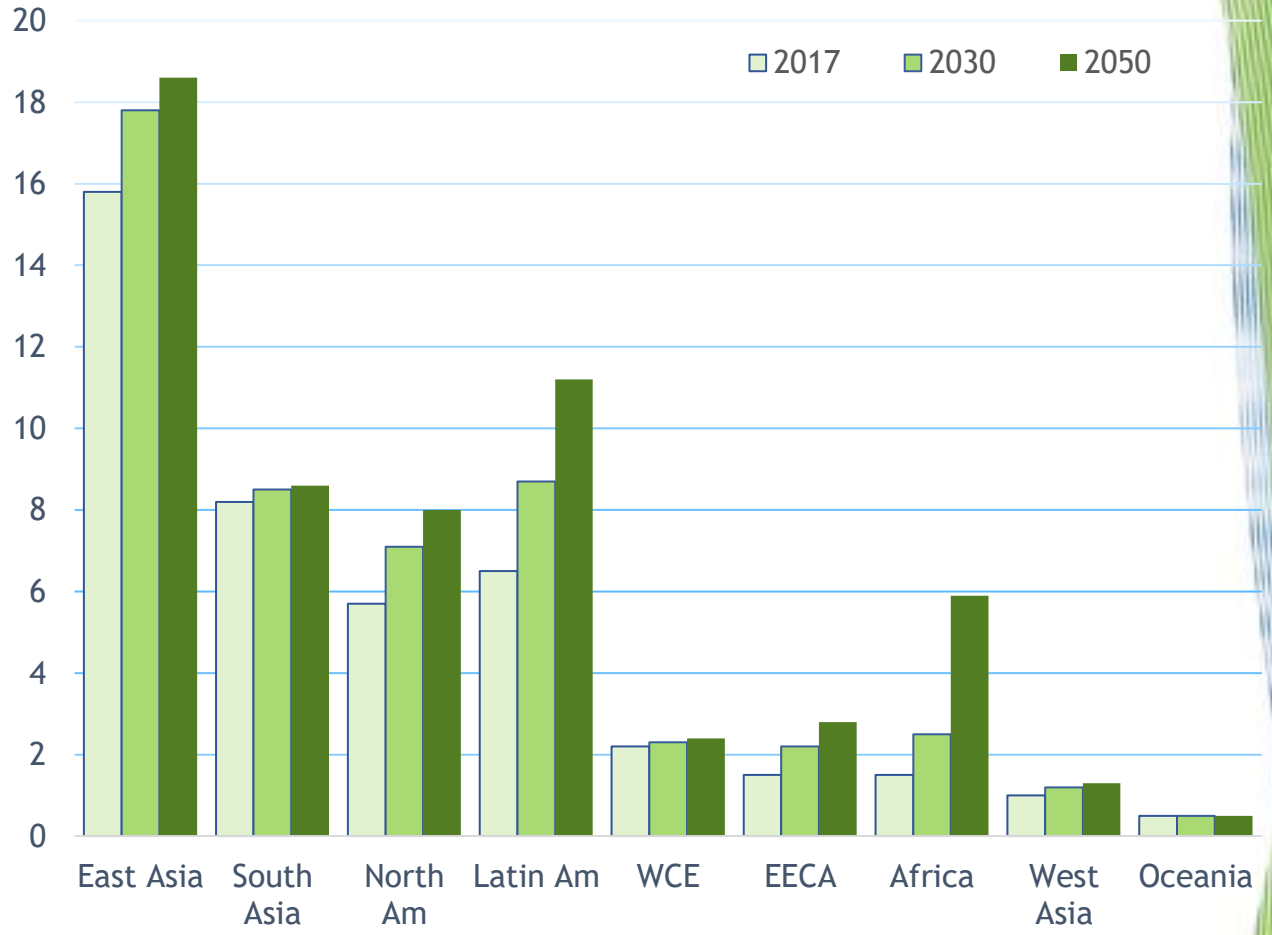
World and Regional P Fertilizer Demand Projections

World P Fertilizer Use (Mt P2O5)



Regional P Fertilizer Use (Mt P2O5) Under the Customized Scenario



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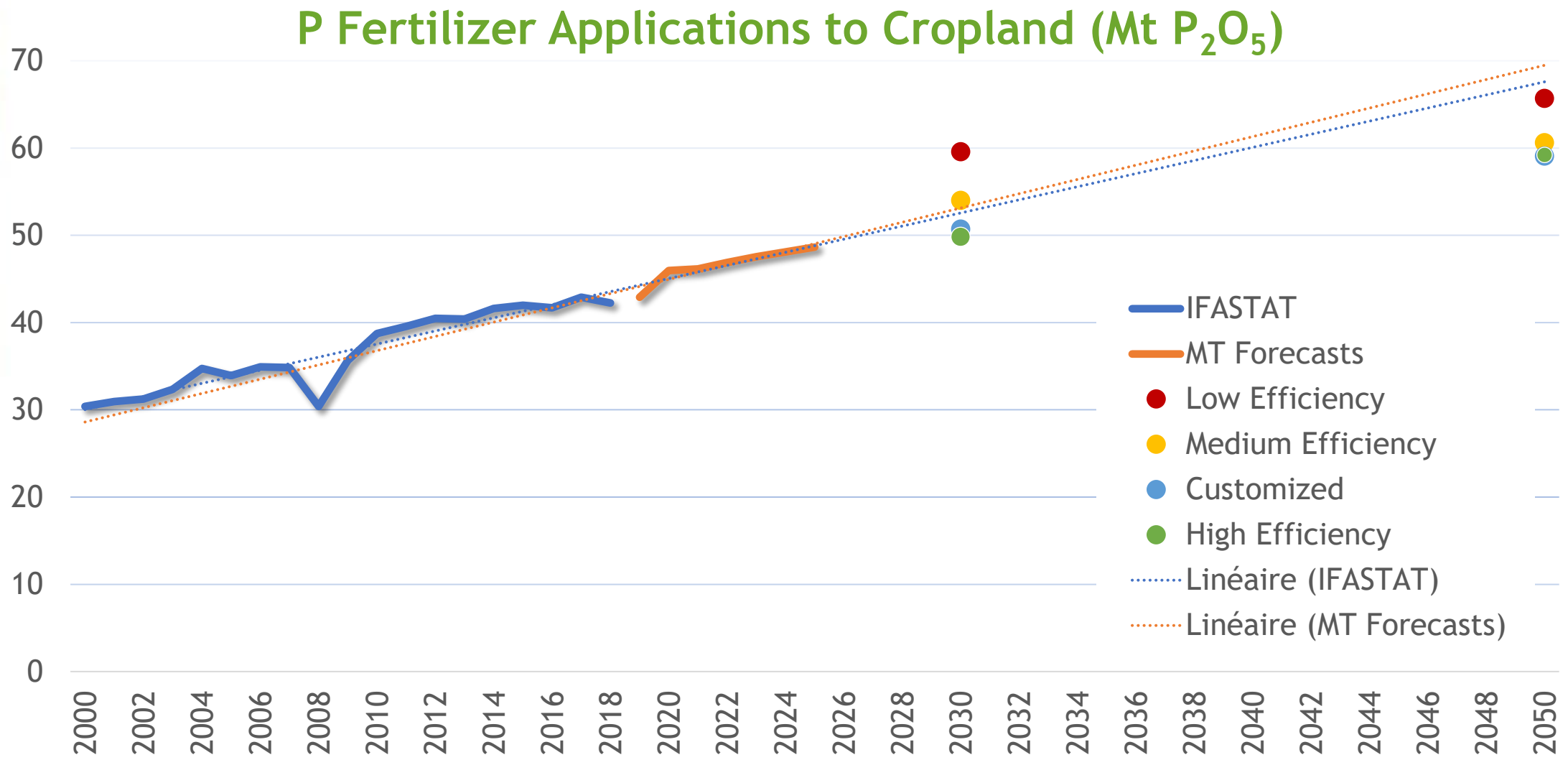

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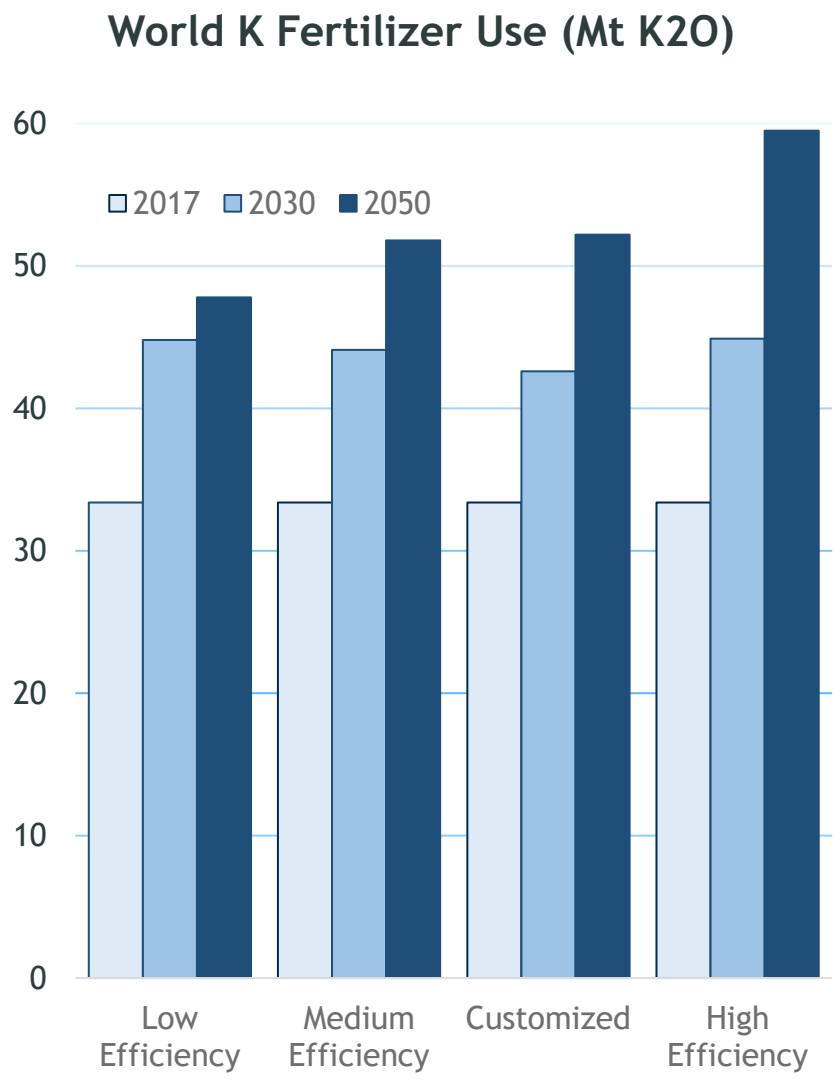
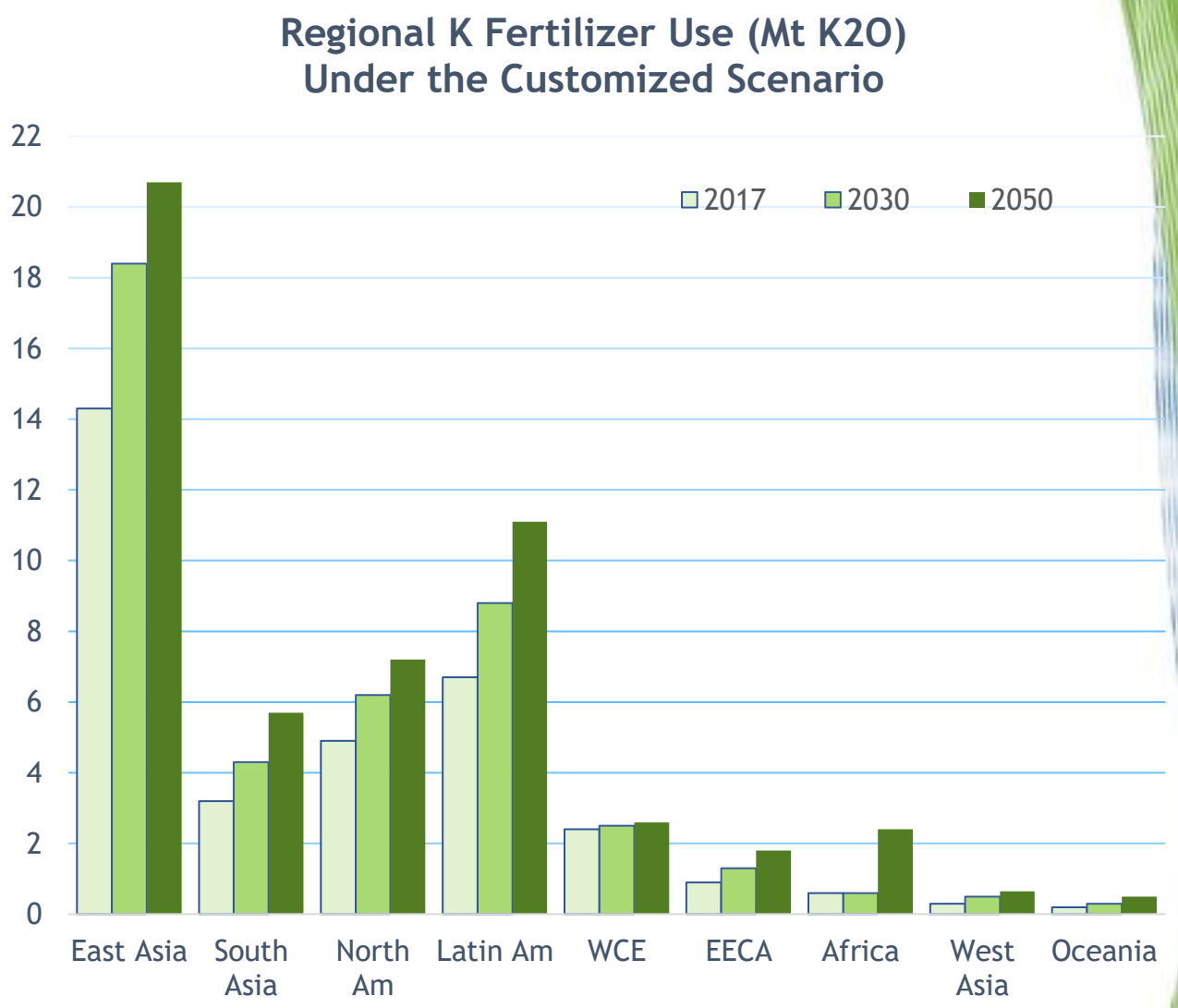
World and Regional K Fertilizer Demand Projections





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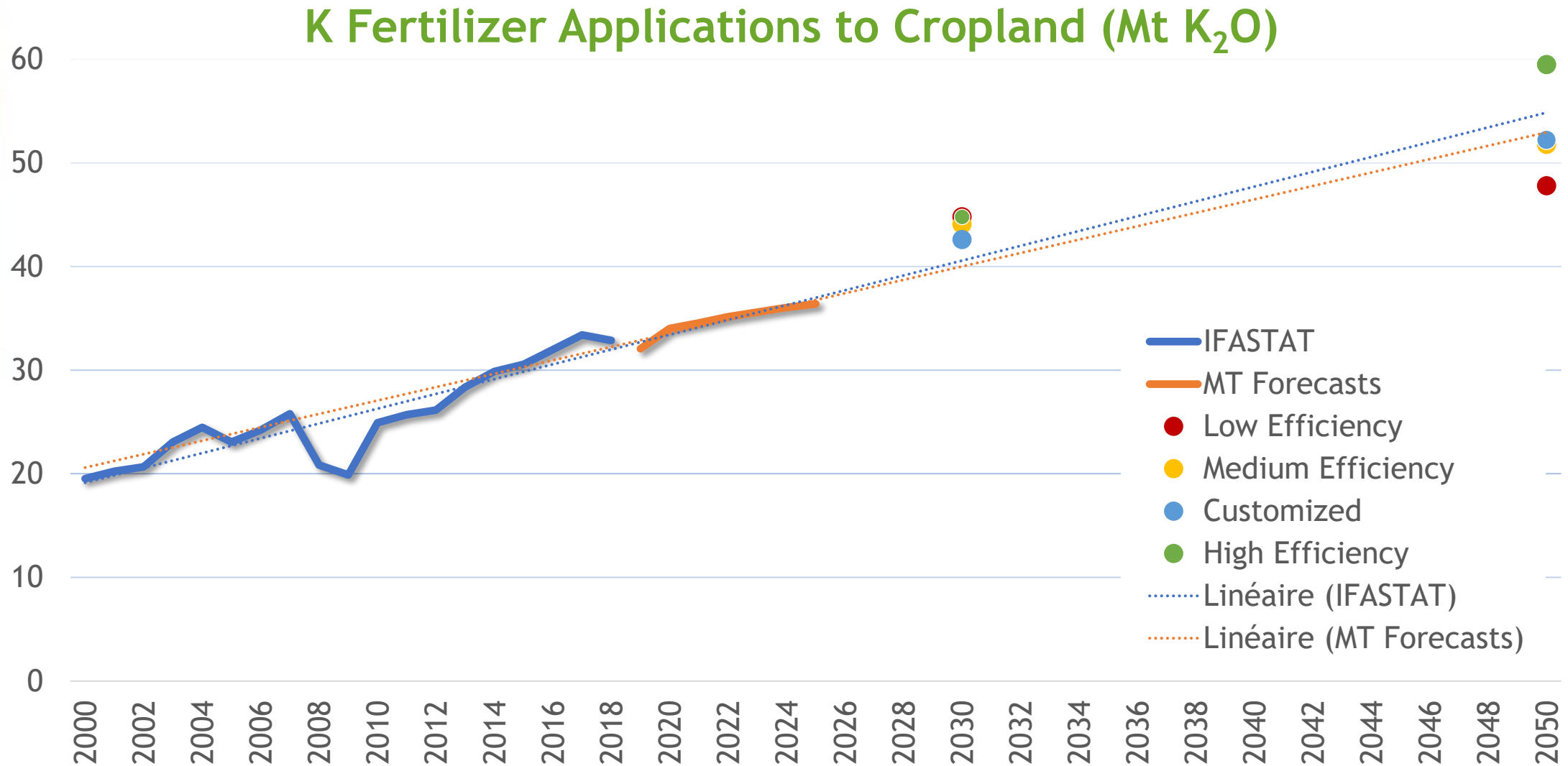

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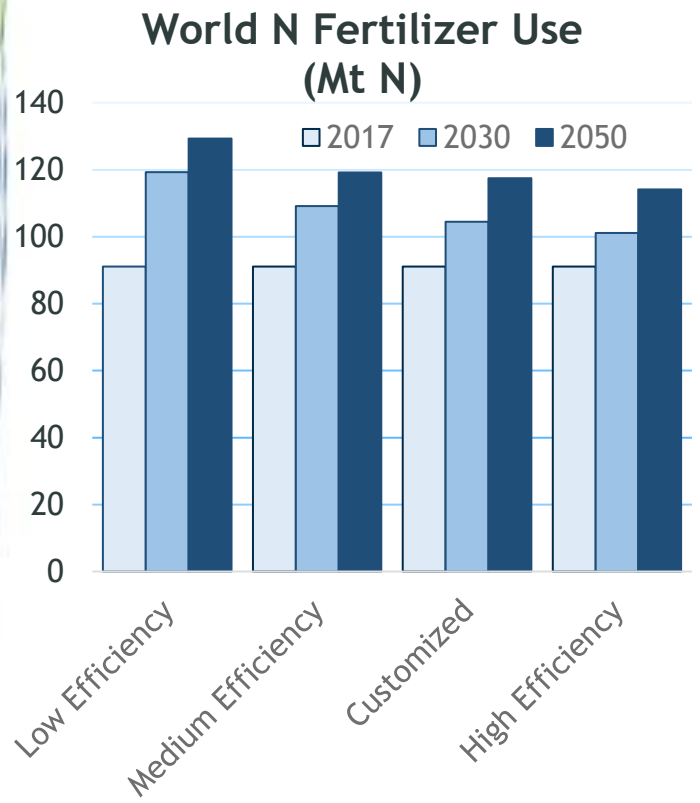
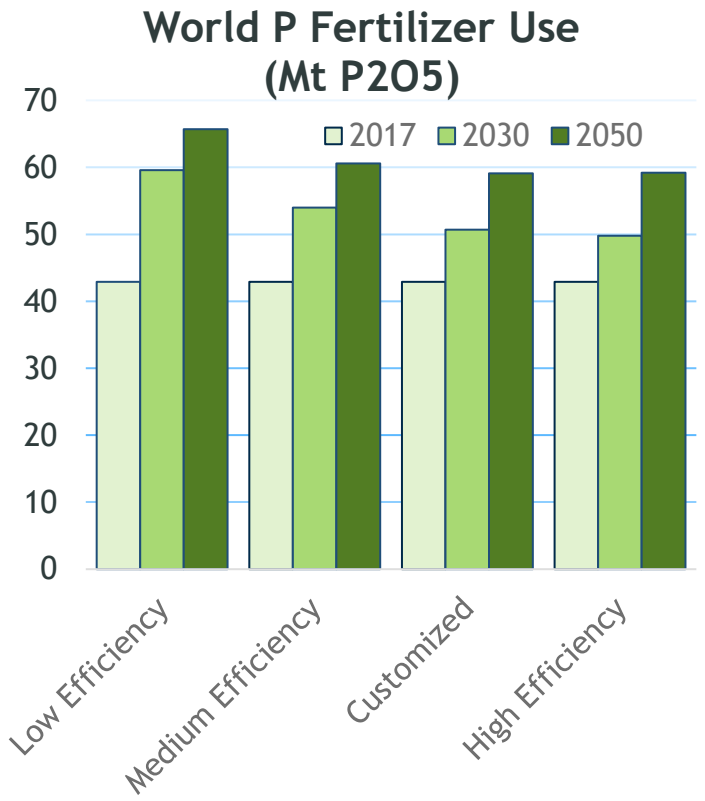
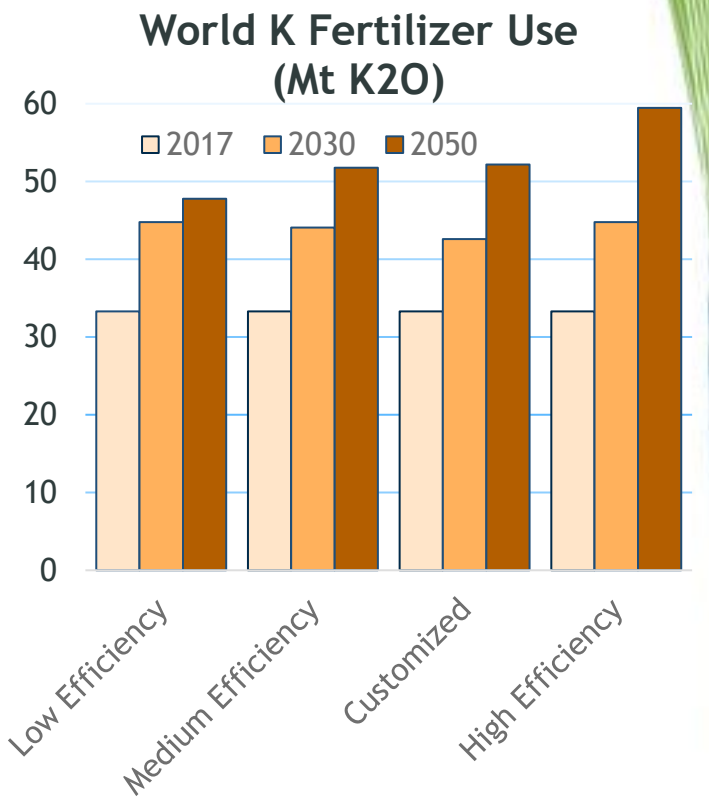
Projections of World N, P and K Applications to Cropland



CAGR	2017 → 2030	2017 → 2050
Low Efficiency	2.1%	1.1%
Medium Efficiency	1.4%	0.8%
Customized	1.1%	0.8%
High Efficiency	0.8%	0.7%



CAGR	2017 → 2030	2017 → 2050
Low Efficiency	2.6%	1.3%
Medium Efficiency	1.8%	1.1%
Customized	1.3%	1.0%
High Efficiency	1.1%	1.0%



CAGR	2017 → 2030	2017 → 2050
Low Efficiency	2.3%	1.1%
Medium Efficiency	2.2%	1.3%
Customized	1.9%	1.4%
High Efficiency	2.3%	1.8%

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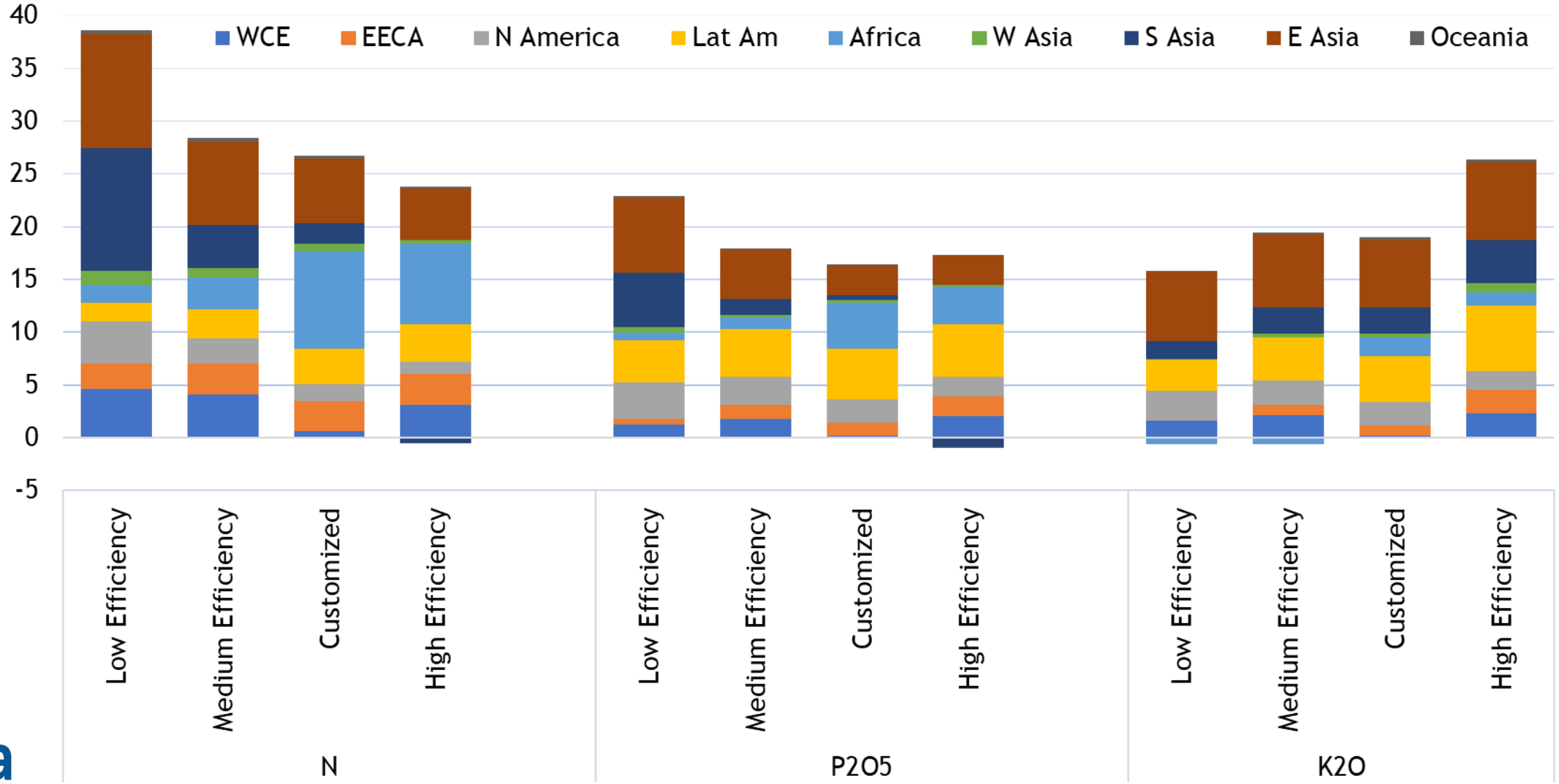
Which Regions Would Contribute to the Projected Increase?

Projected Fertilizer Use Increase Between 2017 and 2050 (Mt nutrients)



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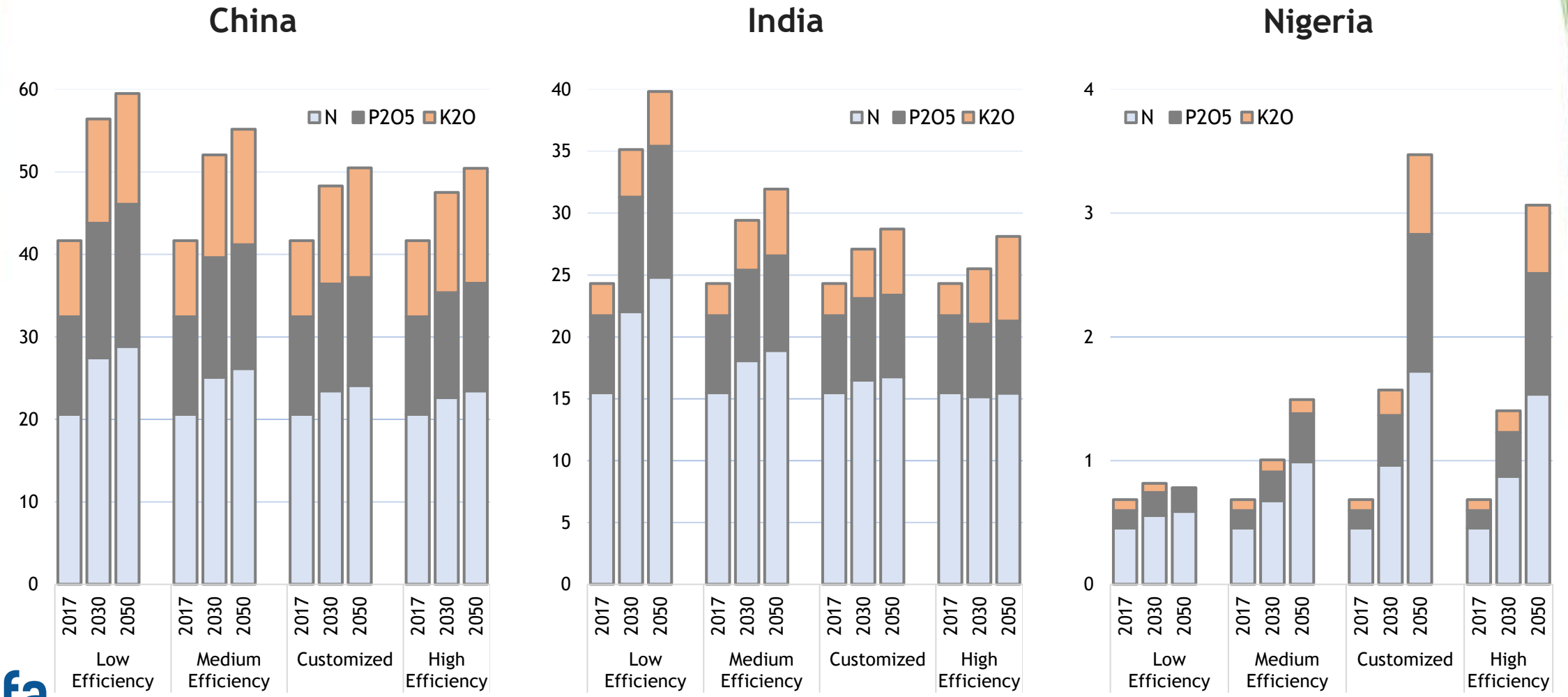
What Scenarios for China, India and Nigeria?

Projected Fertilizer Use (Mt nutrients)



Wrap Up

Significant Uncertainties

- ✓ **FAO's agricultural projections**, e.g. relative to cropland expansion, dietary changes/meat consumption, reduction in food losses/waste.
- ✓ **Quality of plant nutrient data**, in particular data on manure application to cropland, crop biological N fixation, fertilizer use by crop, and nutrient removal by harvested crops.
- ✓ **Bioeconomy growth**, including biomass production (for bioenergy, biomaterials, etc.), and nutrient recycling from waste streams other than livestock manure.
- ✓ **Technology and policy developments** that could influence agricultural or nutrient management futures.

Important note
Analysis limited to cropland
→ **it does not reflect scenarios for total fertilizer demand**

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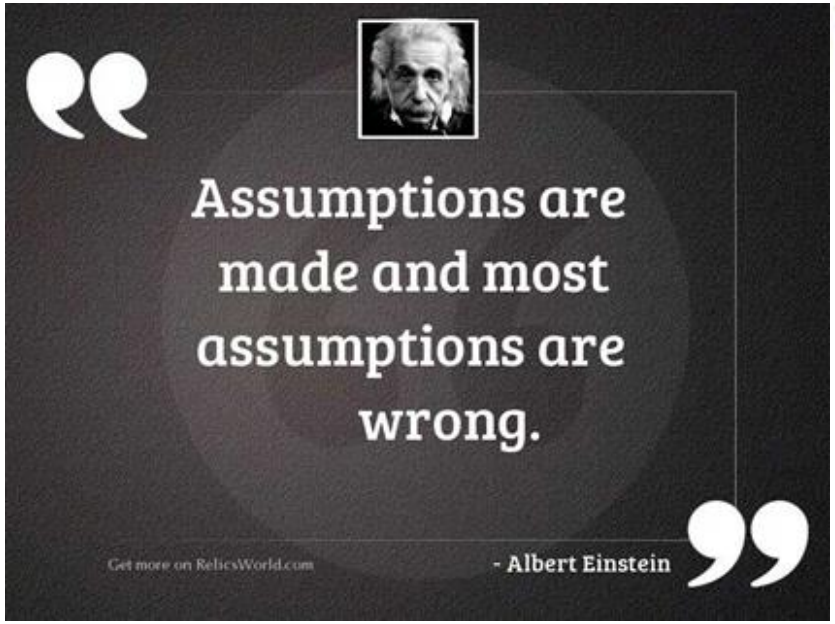
Key Findings

- ✓ Global fertilizer use on cropland is projected to continue increasing between 2017 and 2050:
  - 0.7% to 1.1% per year for N
  - 1.0% to 1.3% per year for P
  - 1.1% to 1.8% per year for K
- ✓ While projected use in 2030 is consistent with current trends, projections point to decelerating growth between 2030 and 2050 for N and P, and possibly accelerating for K
- ✓ Asia remains the key driver of projected growth under the low efficiency scenario, whereas Latin America and Africa are the main contributors under the customized and high efficiency scenarios
- ✓ Are the customized and high efficiency scenarios ambitious enough to keep our license to operate?



Important note

These are projections under different scenarios, not forecasts of what the future is most likely to look like

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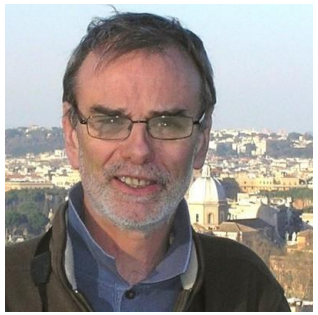
Thank you



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and all the members of the Task Force on Long-Term Demand Scenarios

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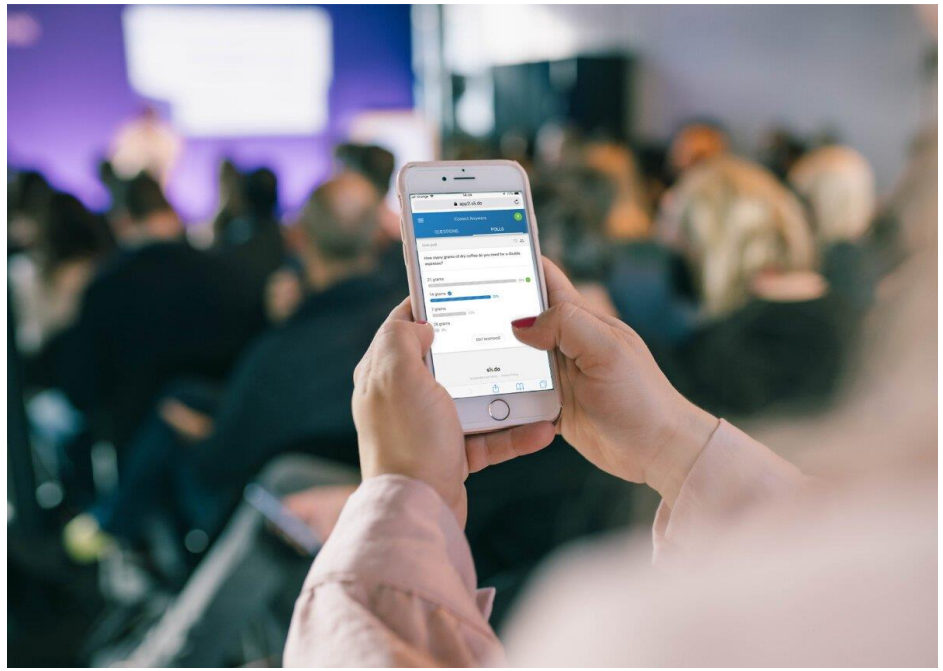

In your view, which scenario is the most likely?

- Low efficiency scenario
- Medium efficiency scenario
- High efficiency scenario
- Customized scenario
- None of them
- I don’t know

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