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Environmental Performance of Brazilian Nitrogen Fertilizers

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SUMMARY

- Brazilian nitrogen fertilizers scenario
- Life cycle assessment
  - Goal and scope definition
  - Inventory analysis
- Conclusions

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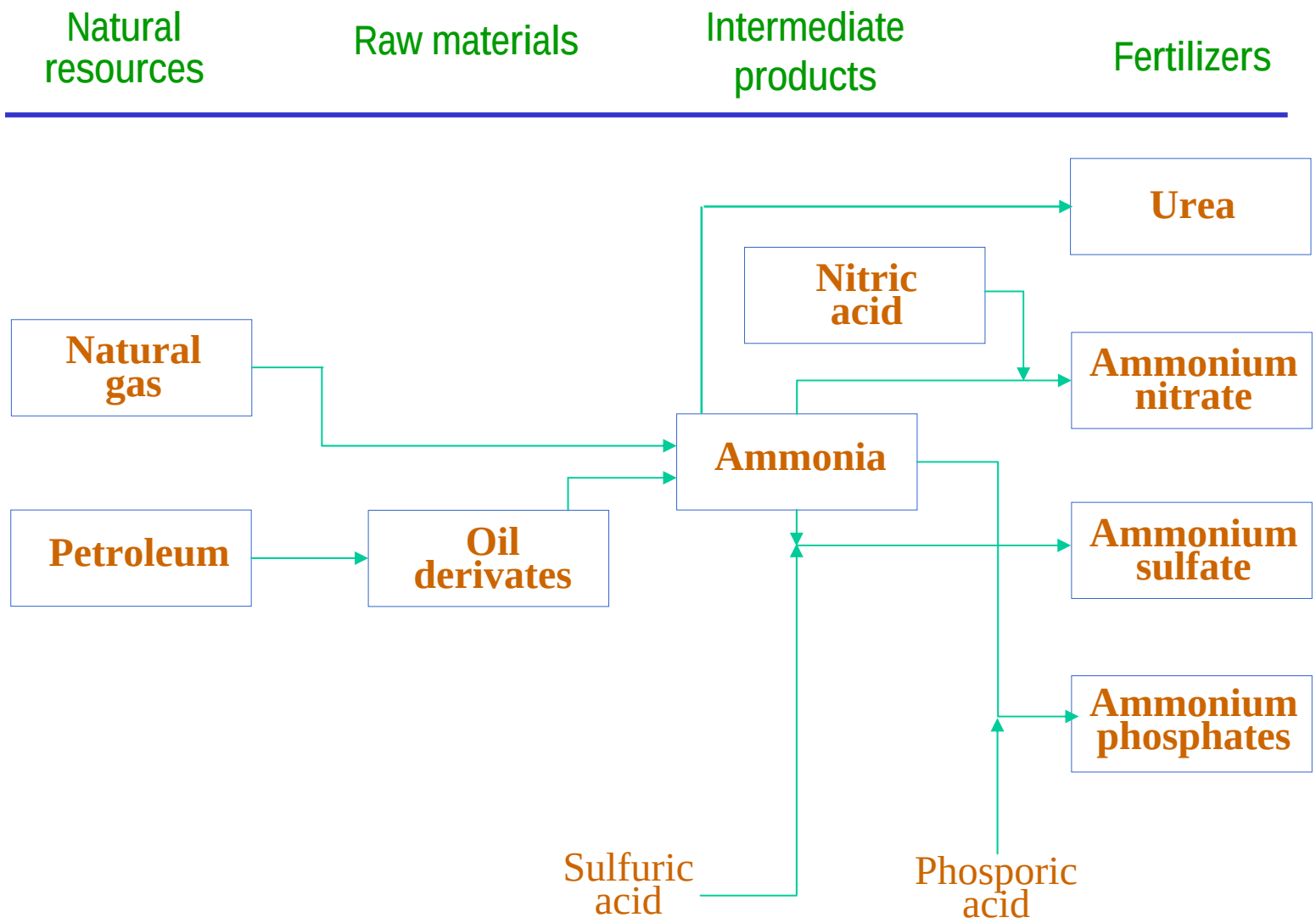
Brazilian nitrogen fertilizers scenario



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Brazilian nitrogen fertilizers scenario

2005 – (ton of N)

	Production	Imports	Apparent consumption
Urea	451,575 (38%)	734,692 (62%)	1,186,267 (100%)
Ammonium nitrate	124,530 (61%)	80,434 (39%)	204,964 (100%)
Ammonium sulfate	45,949 (14%)	283,917 (86%)	329,866 (100%)
Others	182,417 (36%)	331,247 (64%)	531,664 (100%)
TOTAL	804,471 (36%)	1,430,290 (64%)	2,234,761 (100%)

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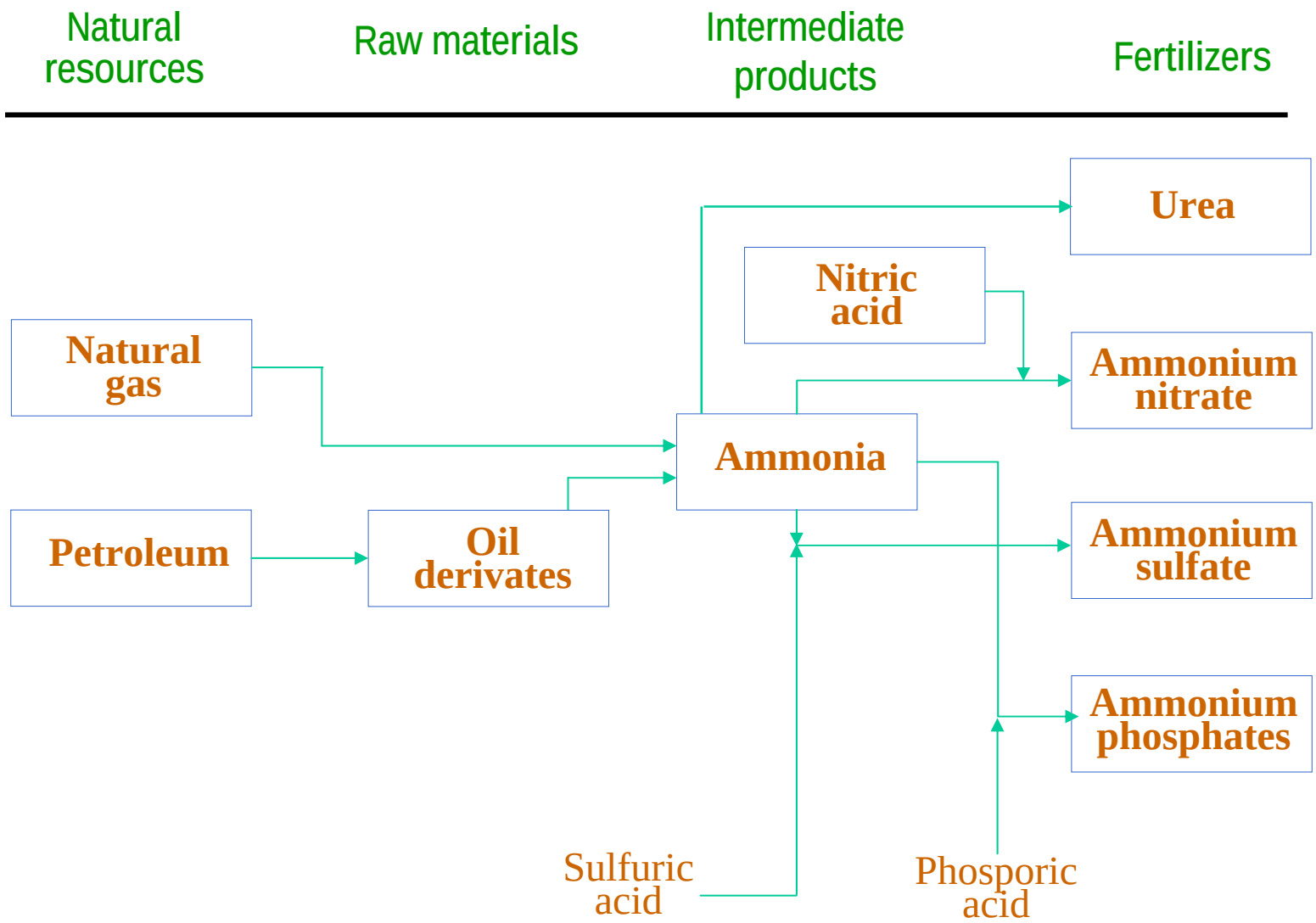
Brazilian nitrogen fertilizers scenario



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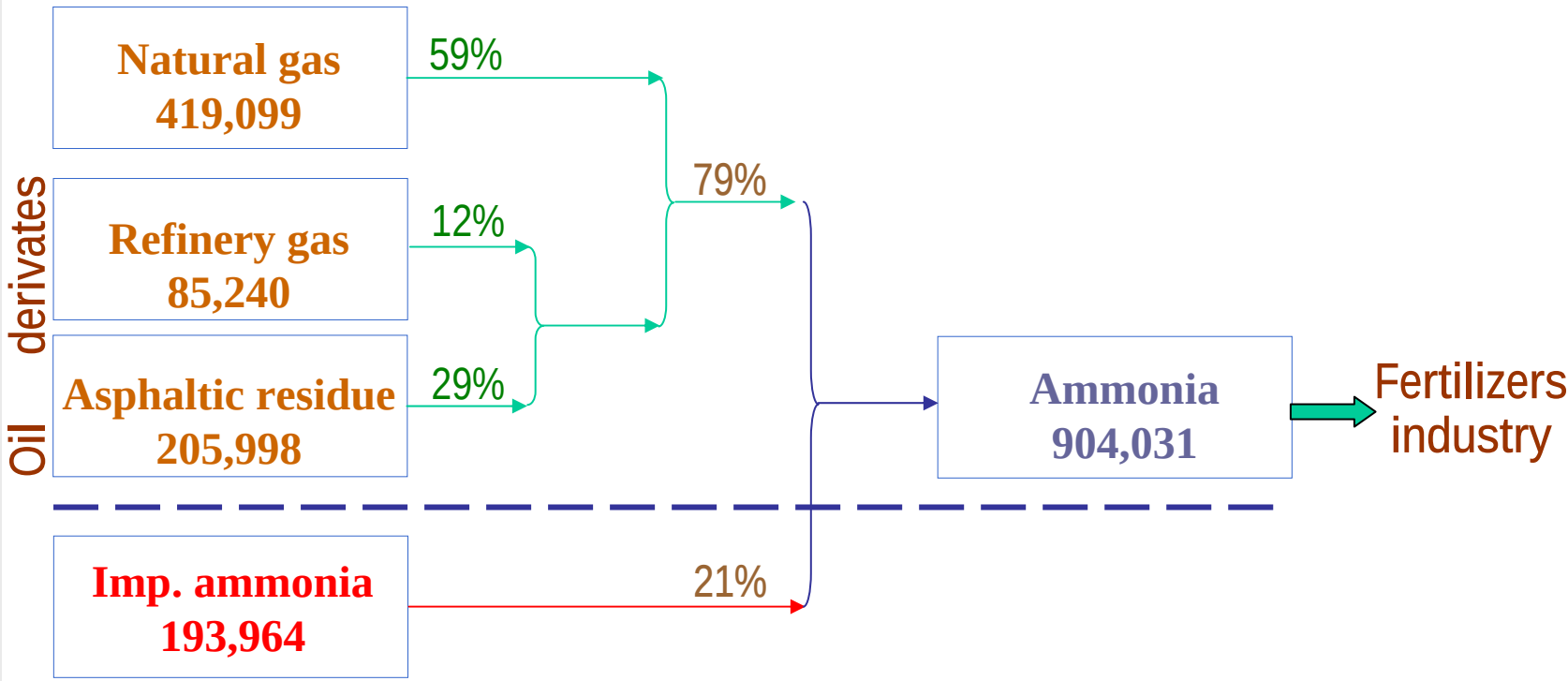
Brazilian nitrogen fertilizers scenario

Ammonia scenario: 2005 – (ton of N)



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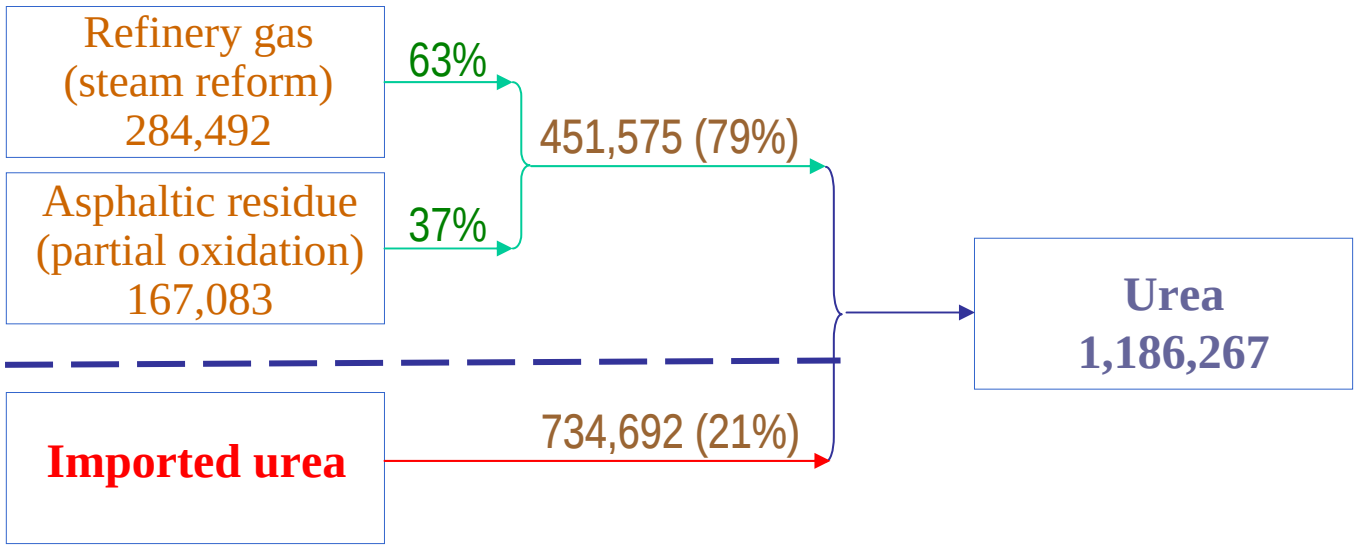
Brazilian nitrogen fertilizers scenario

Urea scenario: 2005 – (ton of N)



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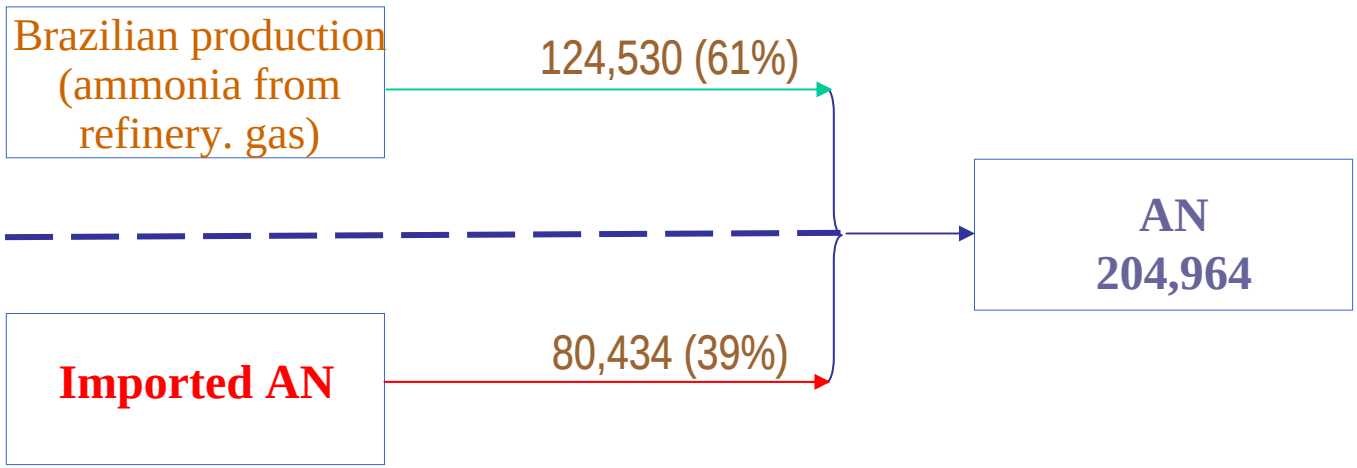
Brazilian nitrogen fertilizers scenario

Ammonium nitrate (AN) scenario 2005 – (ton of N)



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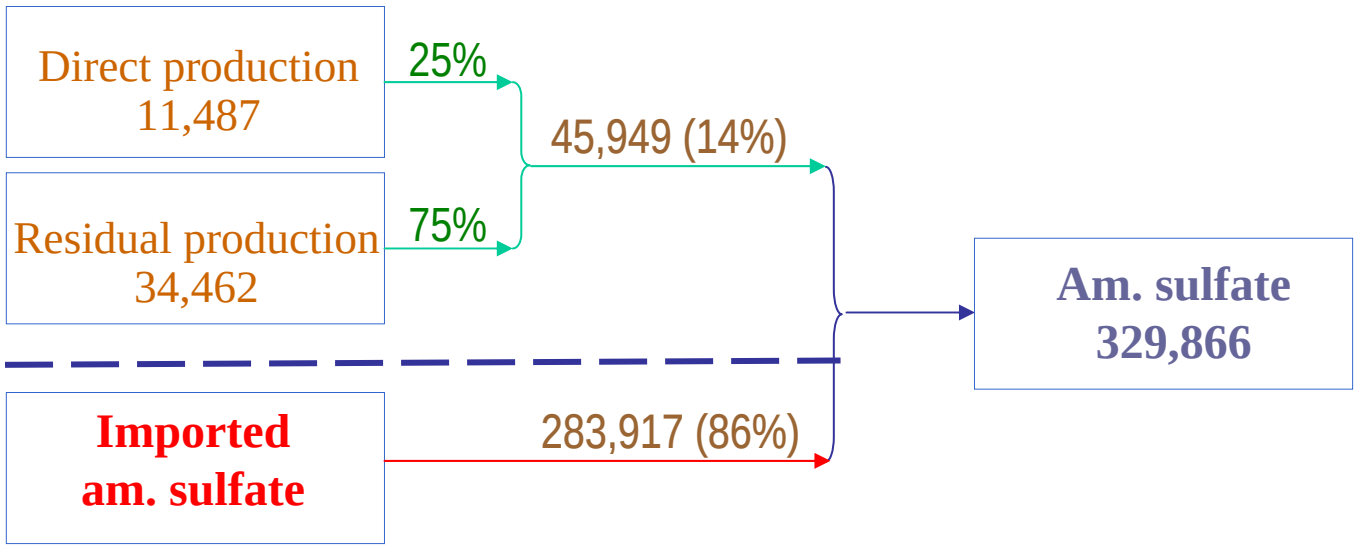
Brazilian nitrogen fertilizers scenario

Ammonium sulfate scenario
2005 – (ton of N)



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Life cycle assessment

Goal and scope definition

Contribute to the construction of a Brazilian database to support LCA studies.

Function: to supply nitrogen to vegetals.

Functional unit: supply 1 ton of N.

Reference flows:

- **Urea (44%N) = 2.27 ton**
- **Ammonium nitrate (33.5%N) = 2.99 ton**
- **Ammonium sulfate (20%N) = 5.00 ton**

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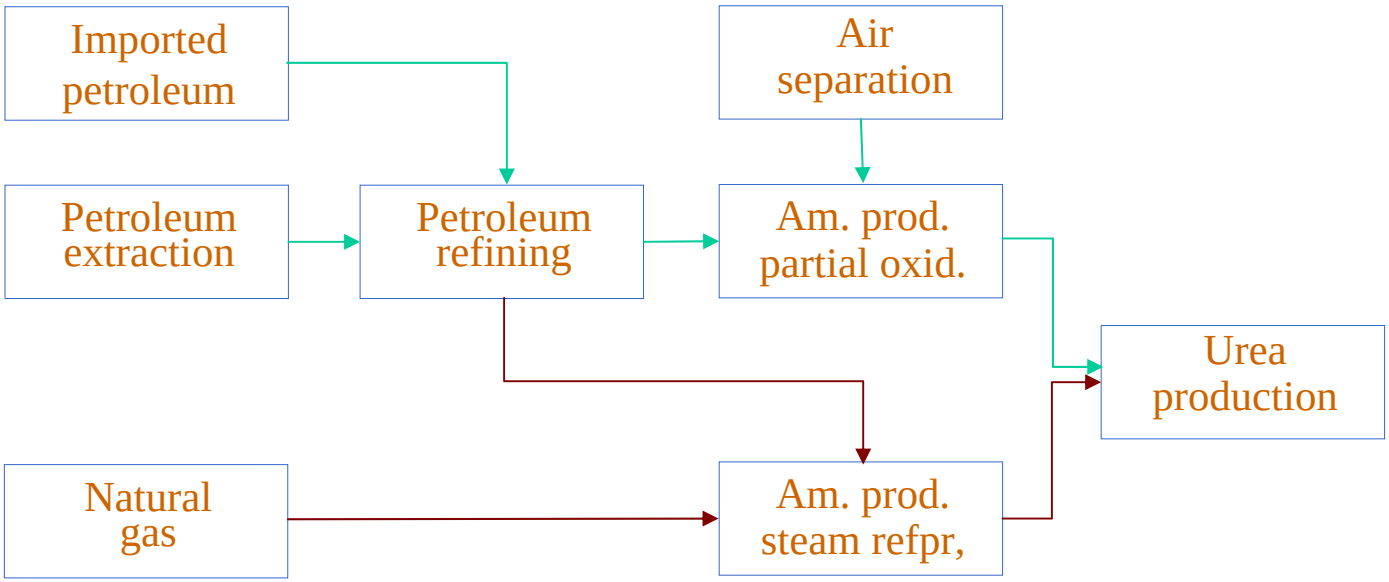
Life cycle assessment

Urea product system



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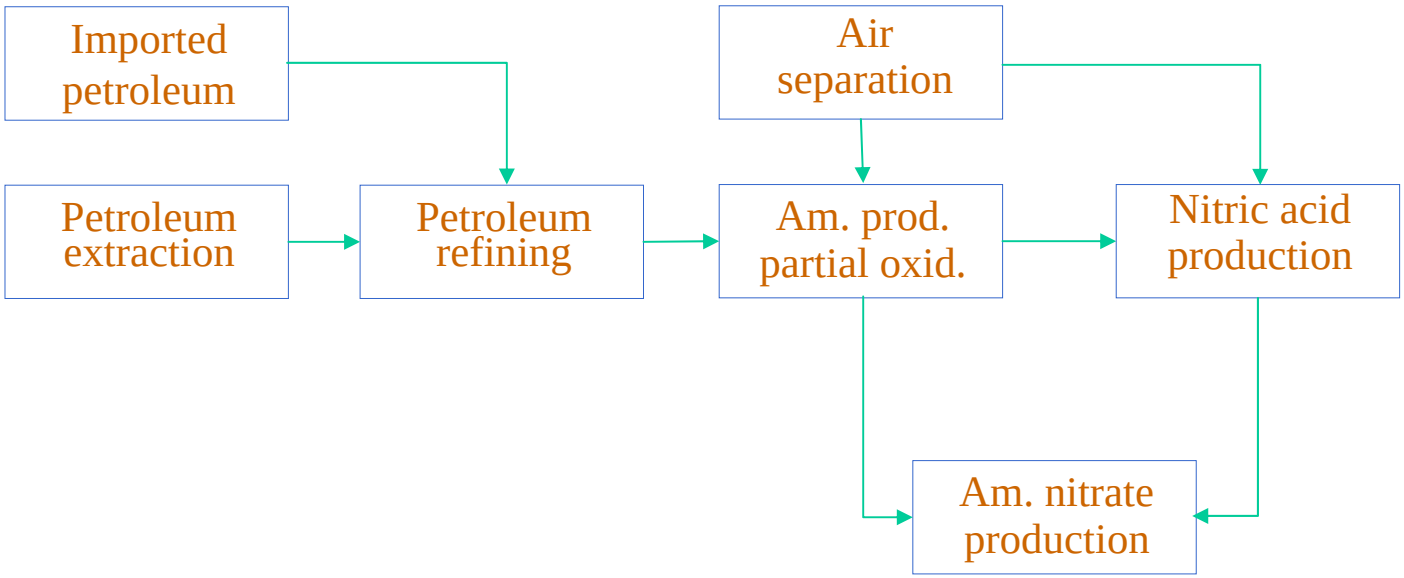
Life cycle assessment

Ammonium nitrate product system



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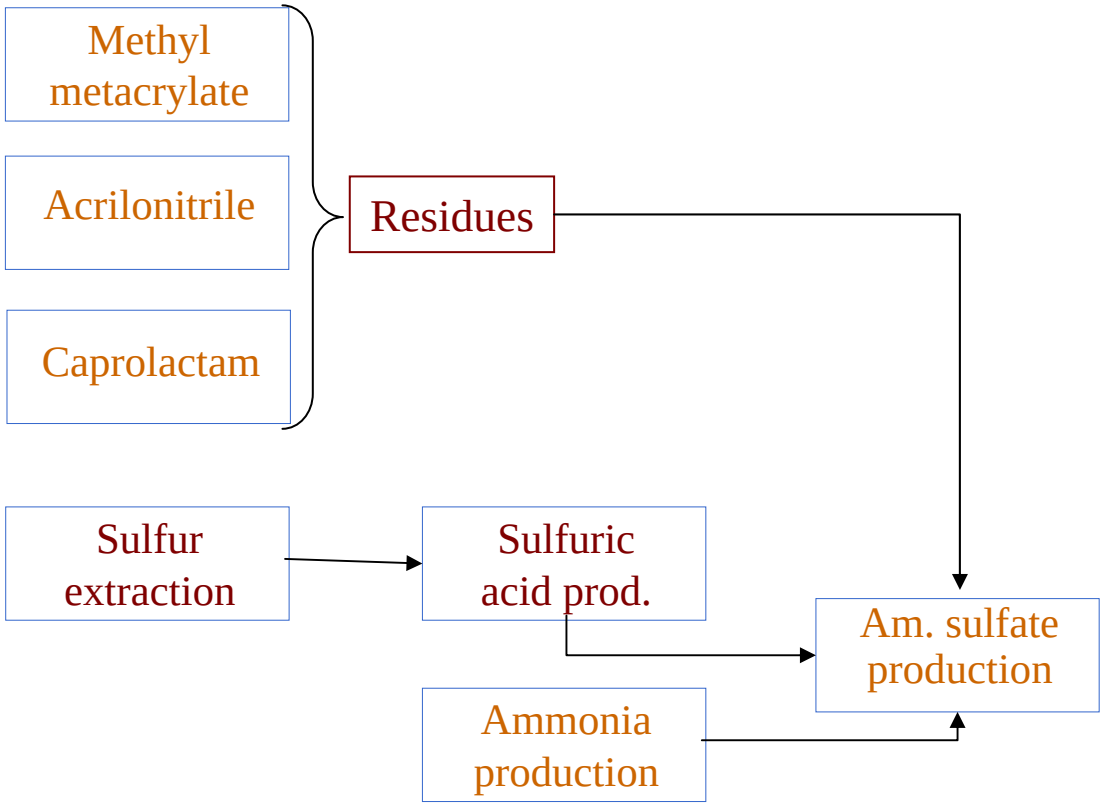
Life cycle assessment

Ammonium sulfate product system



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Life cycle assessment

Inventory analysis

Aspect	Unit	Urea	Am. nitrate	Am. sulfate
Inputs				
Petroleum	kg	9.26×10^3	7.93×10^3	1.04×10^3
Natural gas	kg	1.16×10^3	24.2	1.14×10^3
Thermal energy	GJ	21.7	18.9	7.08
Elementary sulfur	kg	-	-	3.07×10^2
Water	kg	8.36×10^5	1.22×10^6	2.28×10^5
Electricity	GJ	40.38	26.84	7.50
Outputs – Atmospheric emissions				
CO_2	kg	2.88×10^3	1.09×10^3	4.75×10^3
CO	kg	1.46	1.8	5.29
NH_3	kg	1.29×10^{-5}	6.2	1.54×10^{-2}
CH_4	kg	2.38	1.55	16.6
SOx	kg	1.82	1.57	19.1

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Life cycle assessment

Inventory analysis (cont.)

Aspect	Unit	Urea	NH_4NO_3	$(NH_4)_2SO_4$
NOx	kg	7.26	17.6	13.8
N_2O	kg	0.08	19.0	1.84×10^{-2}
Outputs – Liquid effluents				
BOD	kg	0.45	3.16	0.22
Nitrogen compounds	kg	0.48	1.09	1.62×10^{-2}
Sulfur compounds	kg	9.92×10^{-5}	4.71×10^{-6}	6.92×10^{-6}
Outputs – Solid wastes				
Catalyst	kg	0.25	0.11	50.9
Sulfur	kg	1.17×10^{-5}	-	6.64
Outputs – Non material emissions				
Steam	GJ	1.76	1.30	0.15

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Conclusions

⇨ **High energy consumption**

⇨ **High non renewable resources consumption (petroleum and natural gas)**

⇨ **Global warming (CO_2 and CH_4 emissions)**

⇨ **Acidification (SOx, NOx emissions)**

⇨ **Eutrophication (nitrogen compounds)**

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THANK YOU

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