

# A political evaluation of carbon feedstock alternatives for the German chemical industry

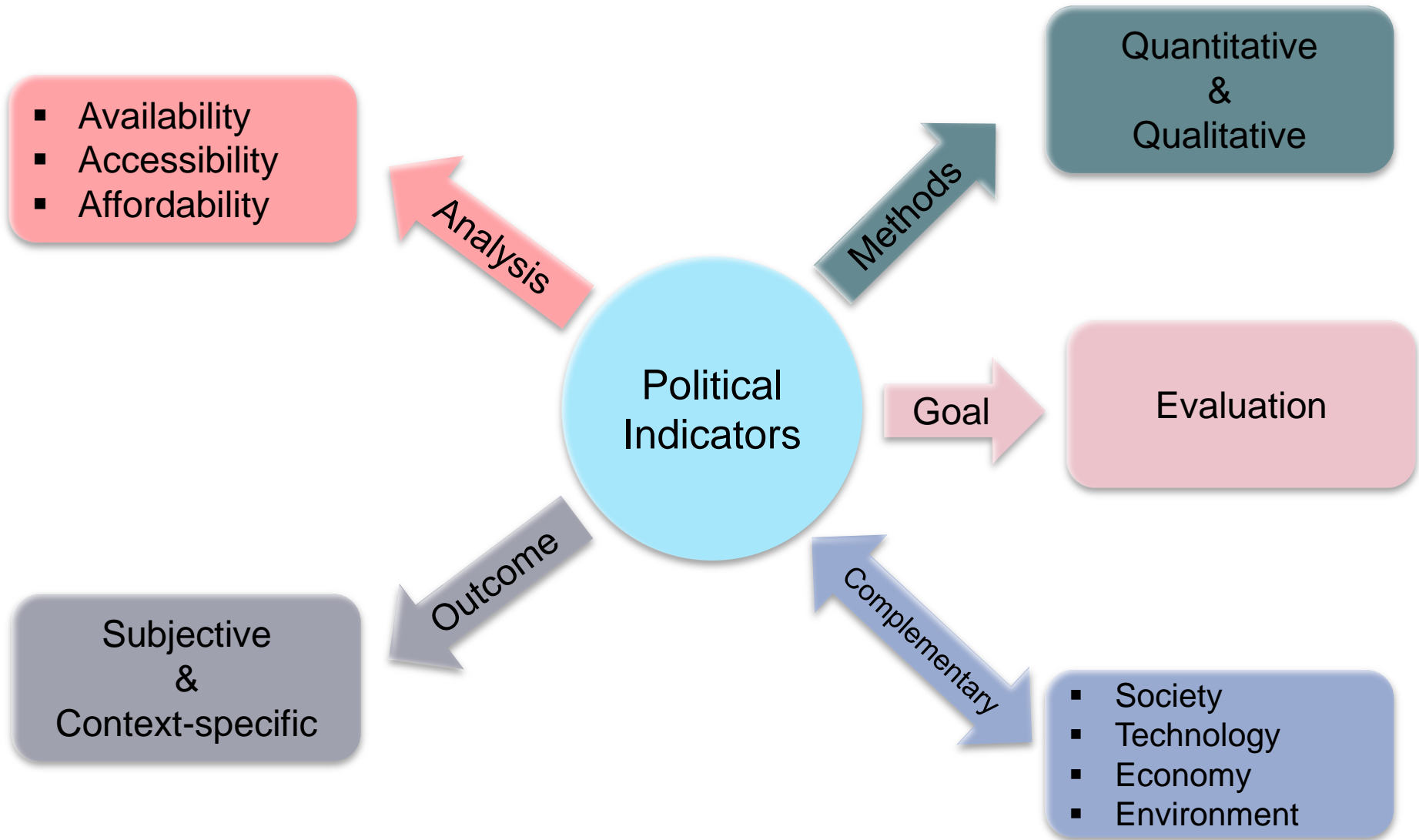
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1. Introduction
2. Political Indicators
  - i. Security of Supply
  - ii. CO2 Costs
  - iii. Regulatory Framework
3. Feedstock Resources and Evaluation
4. Conclusion

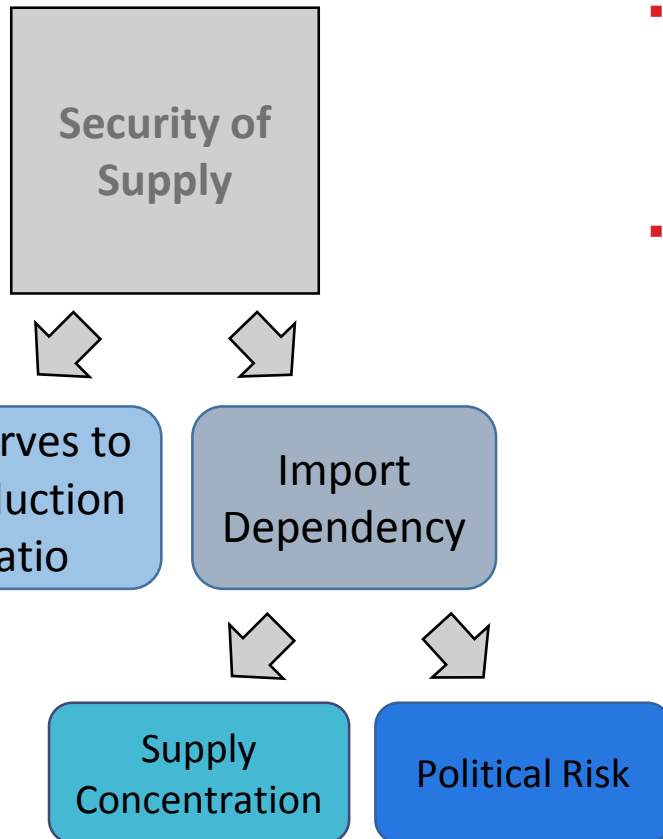
# 1. Introduction





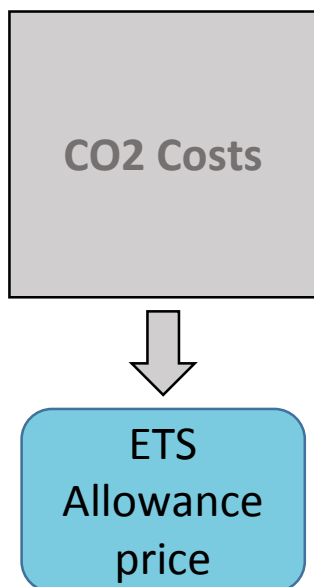
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## 2. Political Indicators



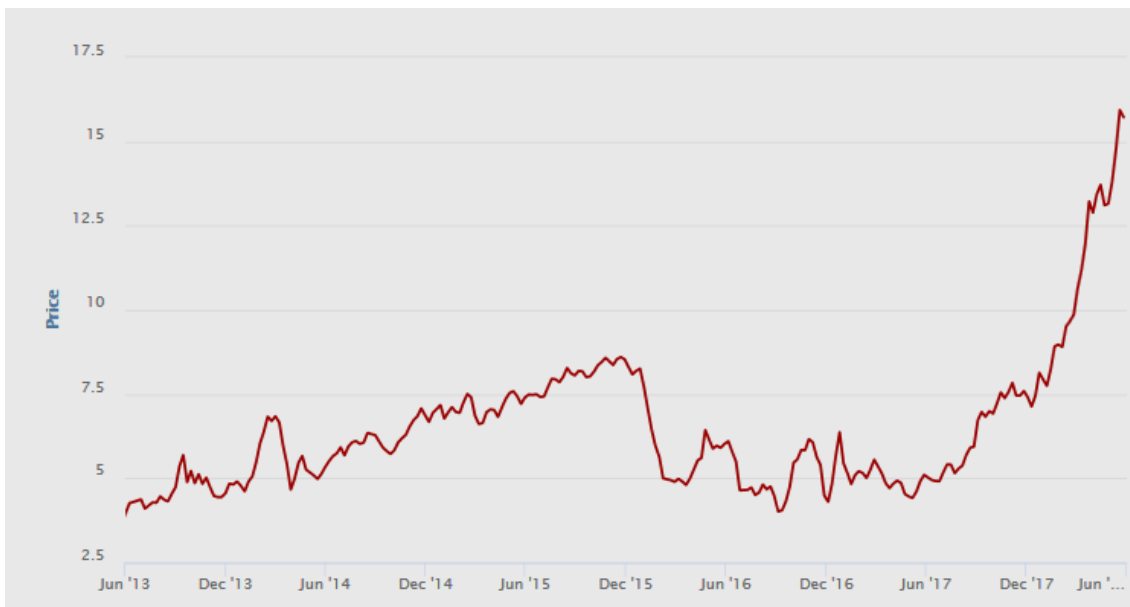
- **Reserves to Production Ratio (RPR)**
  - Static projection of theoretical production range
  - Does not apply to renewables
- **Import Dependency**
  - Quantitative and qualitative aspects (IEA Methodology):
    - Supply Concentration – *Herfindhal-Hirschman Index (HHI)*
      - $HHI = \sum_i (S_i^2)$
      - Range: 0-10.000
    - Political Risk – *Worldwide Governance Indicators (WGIs)*
      - Pol. Stability, Regulatory Qual., Rule of Law (5y average)
      - Range: -2.5 to 2.5, inverted to 1-5
  - Combination:  $ID = \sum_i (R_i * S_i^2)$ 
    - Range: 0 – 50.000
    - Higher score = lower security of supply
- Additional resource-specific qualitative aspects (e.g. interdependency)

## 2. Political Indicators



### ■ EU ETS

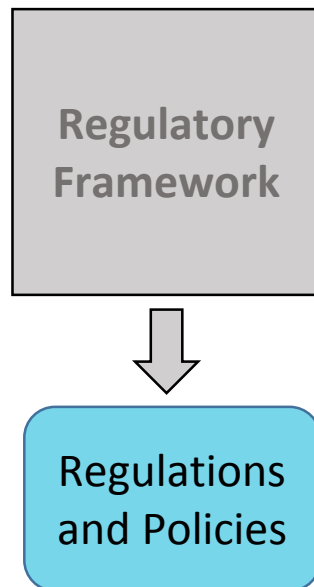
- price development of CO2 Allowances in Phase IV
- current price: 15,50€/t (4.6.2018, 7-year high)
- Price expectation Phase IV: 20 €/t in 2020, 30-35€/t in 2030\*



Retrieved from EEX, 5.6.18

- Evaluation of impact on each resource

## 2. Political Indicators



- **Regulations and policies** at EU and national level
- **Qualitative impact evaluation** on case-by-case basis
  - Favourable conditions, subsidies etc.
- Based on document analysis and secondary literature



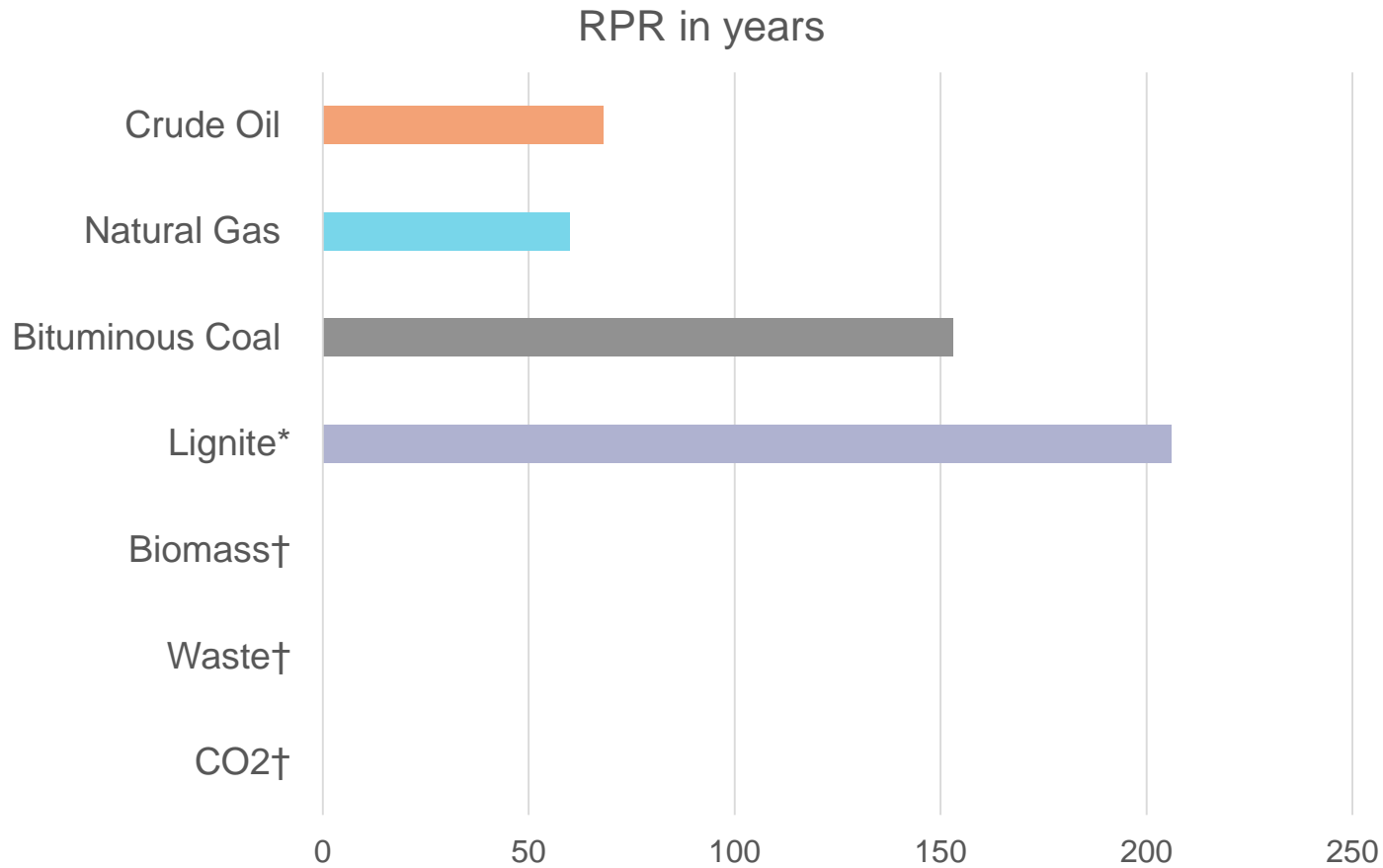


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# 3. Feedstock Resources and Evaluation



## SoS – Reserves to Production Ratio



\*domestic reserves, † not applicable, Sources: IEA, BMWi, BP

### 3. Feedstock Resources and Evaluation

#### SoS – Import Dependency Scores

	Oil	Gas	Bit Coal	Lignite	Biomass*	Waste*	CO2
Import Share	97%	94%	93.2%	0.026%	-	-	-
Dependency Score	7318.06	8035.18	5979.18	0	0	0	0

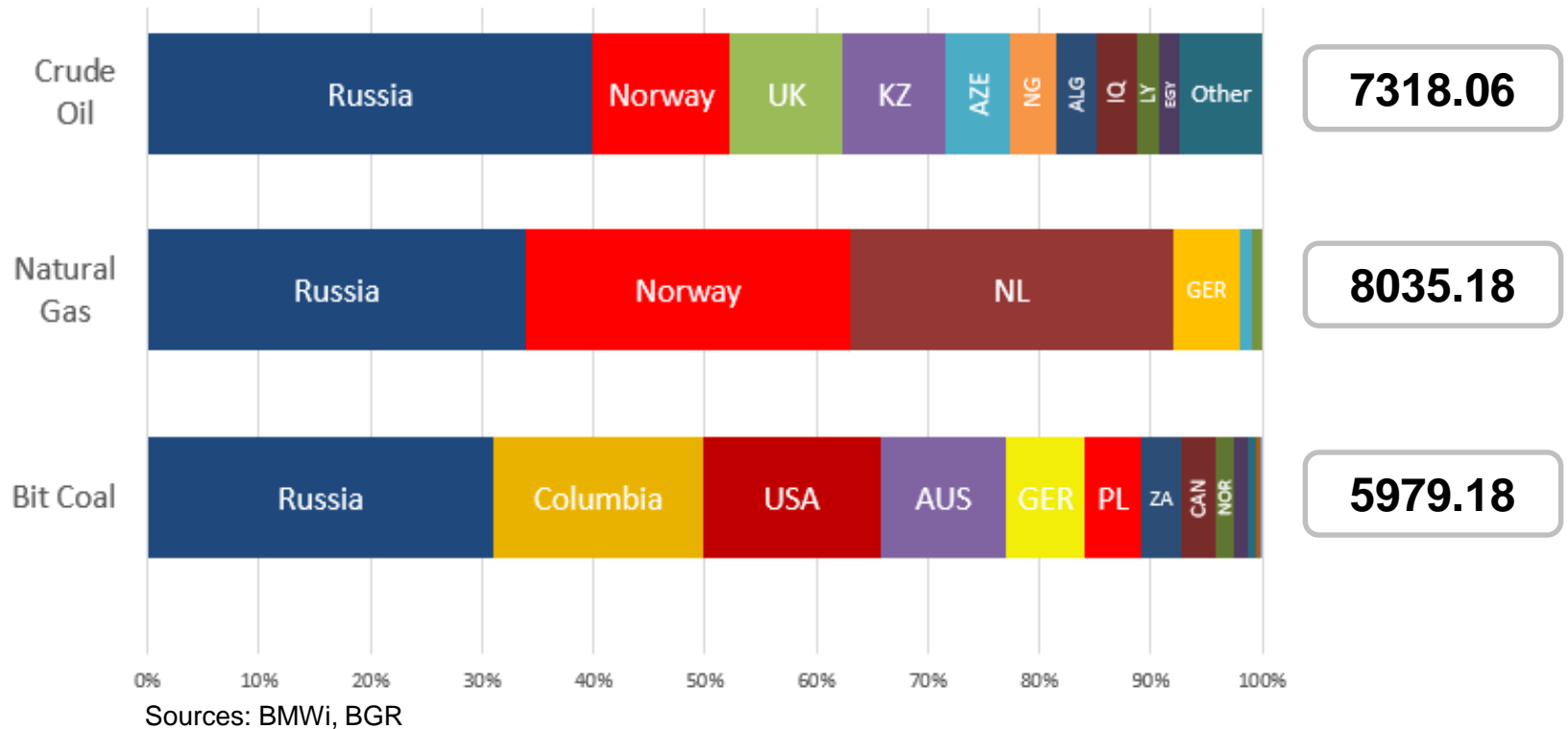
Sources: BMWi, BGR, World Bank

\*Biomass: Biogas and Wood Waste; Waste: Municipal Waste and Sewage Sludge

# 3. Feedstock Resources and Evaluation



## SoS – Import Dependency Overview



Diversification

Russia

European Production

# 3. Feedstock Resources and Evaluation

## SoS – Import Dependency

### Qualitative Aspects:

Crude Oil	Natural Gas	Bituminous Coal
<ul style="list-style-type: none"><li>▪ Freely tradeable</li><li>▪ 66% of reserves located in Middle East + Central/ South America</li></ul>	<ul style="list-style-type: none"><li>▪ Pipeline-bound</li><li>▪ EU Market Power</li><li>▪ Interdependence</li><li>▪ EU Diversification Strategy</li></ul>	<ul style="list-style-type: none"><li>▪ Domestic production ends 2018</li><li>▪ Declining demand in EU and Germany</li></ul>

## CO2 Costs

- **Core assumptions** for rising CO2 costs:
  - Increased incentive to re-use CO2-emissions as carbon feedstock
  - Shift from coal to gas in power generation

### Natural Gas

- Increasing demand in PG
- competition

### Bit Coal

- Decreasing demand in PG
- No utilization incentive

### Lignite

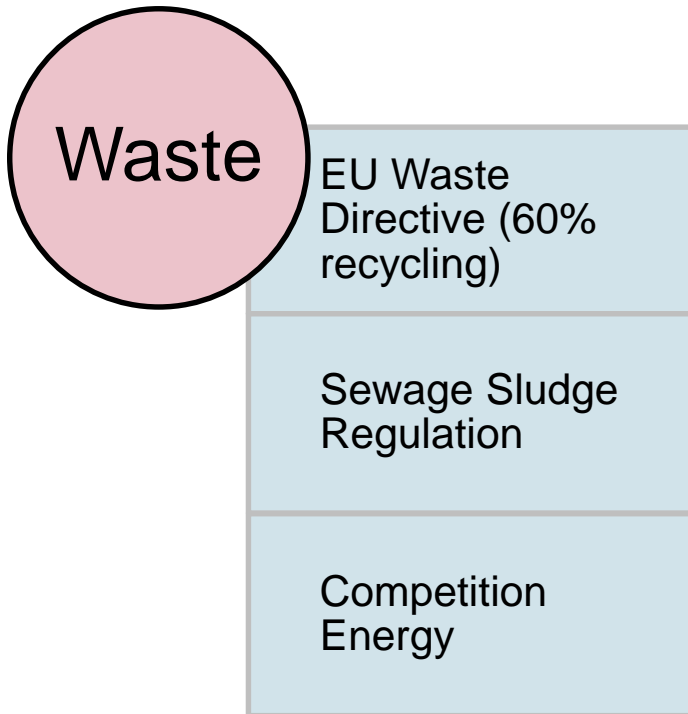
- Decreasing demand in PG
- Availability + price incentive

### CO2

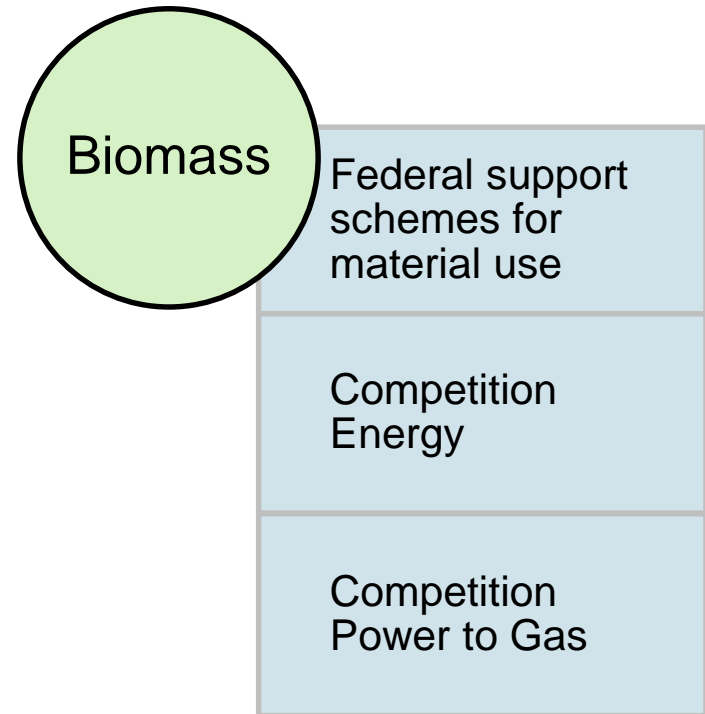
- Financial incentive for re-use (CCU/S)

# 3. Feedstock Resources and Evaluation

## Regulatory Framework



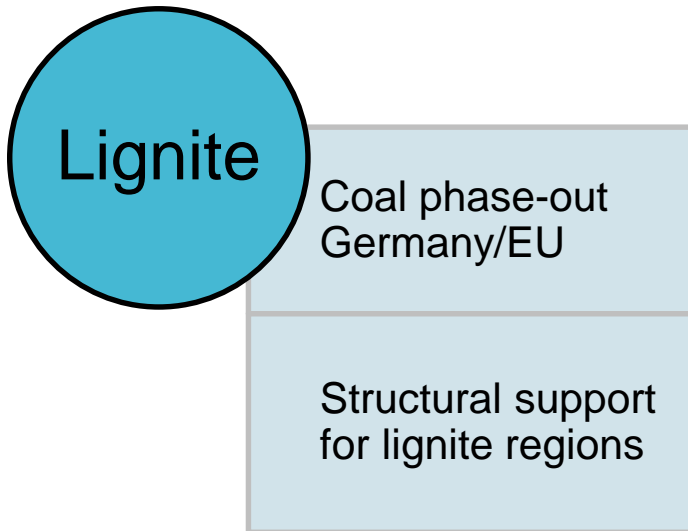
- + Availability Waste&SS
- Competition



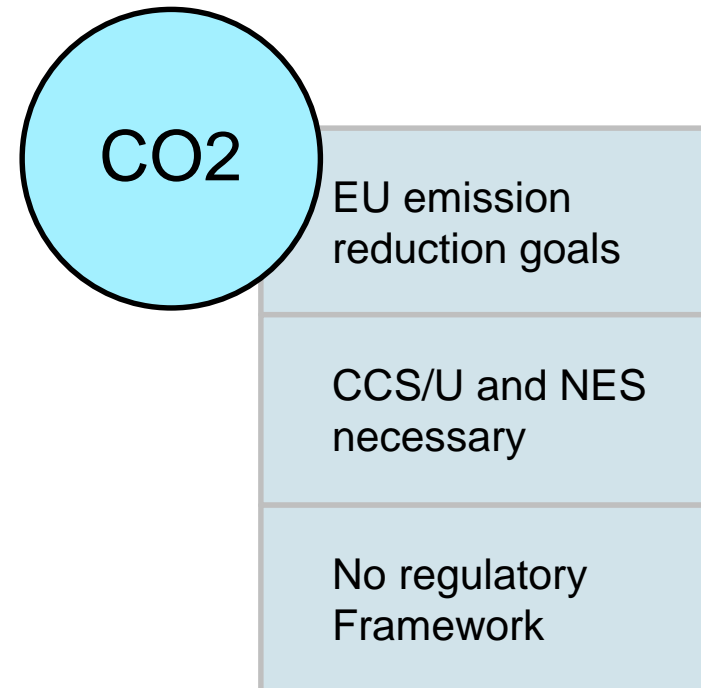
- + Political Support
- Increasing competition

# 3. Feedstock Resources and Evaluation

## Regulatory Framework



- + Availability
- + Political Support



- + Availability (?)
- Regulatory Framework



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## 4. Conclusion

- Political evaluation of feedstock resources for the chemical industry in Germany:

### Conventional Feedstock

#### Import Dependency

- Oil
- Gas

#### Limited Availability

- Oil
- Gas

#### Competition

- Gas

### Alternative Feedstock

#### Regulatory Framework

- Lignite
- Biomass
- Waste

#### Availability

- Lignite
- Waste
- (CO<sub>2</sub>)

#### Competition

- Waste
- Biomass

# Thank you for your attention!



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