

# Addressing the role of coal in a sustainable energy future

GROUP OF EXPERTS ON CLEANER ELECTRICITY SYSTEMS

15TH SESSION

GENEVA, 5-6 NOVEMBER 2019, PALAIS DES NATIONS, SALLE XI

**Judd Swift**

# International Coal

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- ▶ 16% of people worldwide lack access to electricity
- ▶ 40% of the global population rely on the traditional use of biomass for cooking – that's 2.7 billion people
- ▶ Sub-Saharan Africa remains the region with the greatest concentration of energy poverty

People without access to modern energy services by region



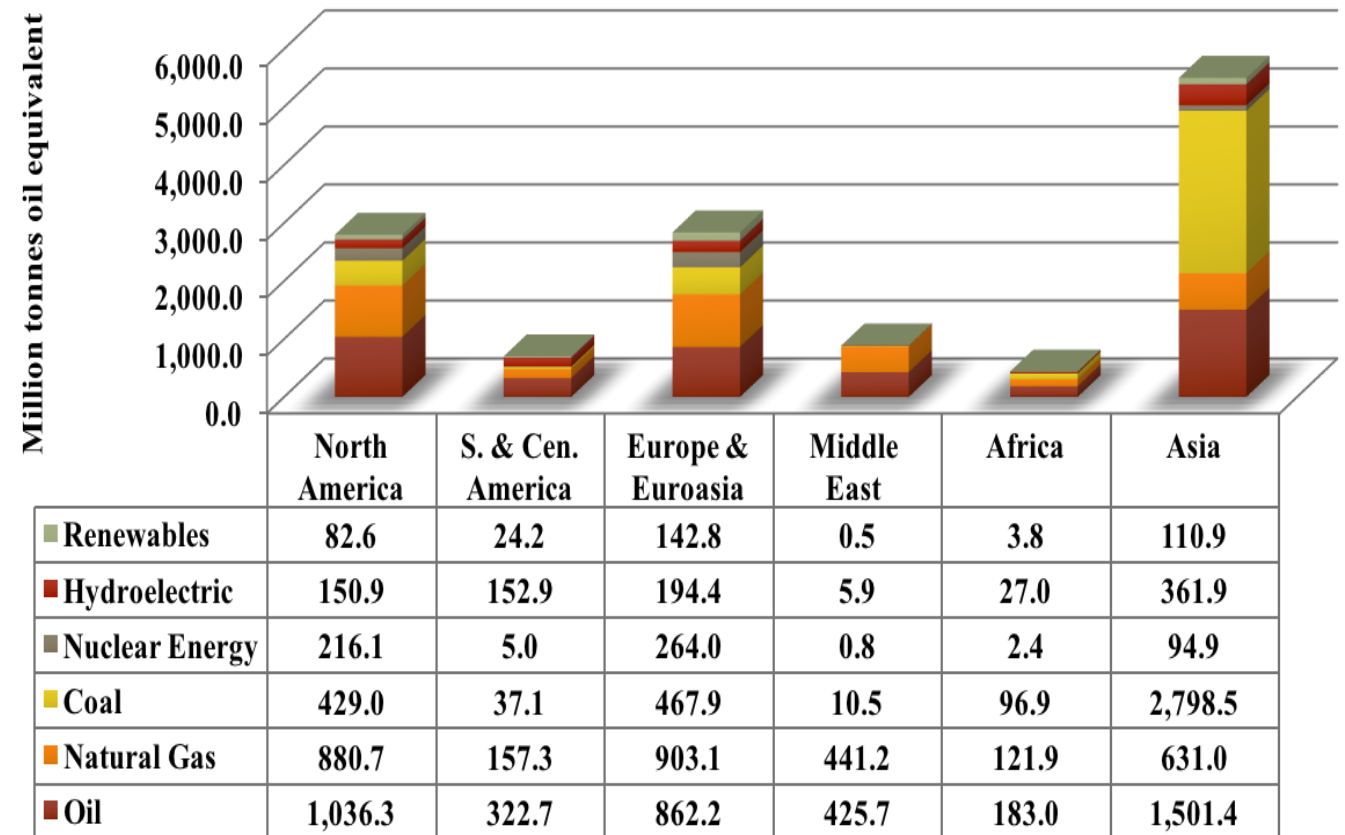
Source: International Energy Agency, World Energy Outlook 2016

# International Coal

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- ▶ Asia consumes almost three times the volume of coal as the rest of the world combined.
- ▶ Note the levels of consumption in Africa, and the relation to development.
  - ▶ It is likely undeveloped regions such as Africa will increase the global demand for cleaner coal as a cheap commodity to fuel development.

Consumption of Primary Energy by Region & Fuel Type, 2015



# International Coal

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- ▶ Center for Global Development illustration of the energy poverty that prevails in the developing world
- ▶ The average American consumes 100 kilowatt-hours of electricity in about **66 Hours**.
- ▶ While the average Tanzanian takes more than a year to use 100 kilowatt-hours of power

## Number of Days Needed to Consume 100 Kilowatt-hours

*Days to use 10kWh*

United States	3	Kenya	235
Euro zone	5	Nigeria	245
South Africa	8	Tanzania	397
Tunisia	28	Ethiopia	702
Ghana	106		

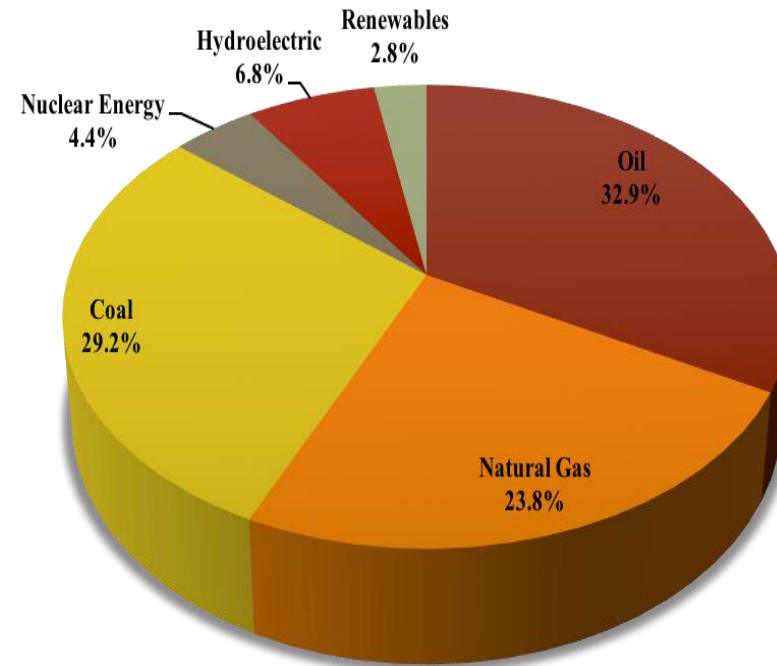
Source: Center for Global Development

# The International Coal Industry-

## In the short-term

- ▶ Supply and demand fluctuations in the market may be signs of equilibrium at a higher spot price.
- ▶ The world consumed 264mm BOE/day in 2015
  - ▶ 29.17% of that was coal
- ▶ Even with growth in other industries, that is a percentage that is unlikely to be overcome by renewables and regional resource advantages

**Primary Energy Consumption by Source, 2015**



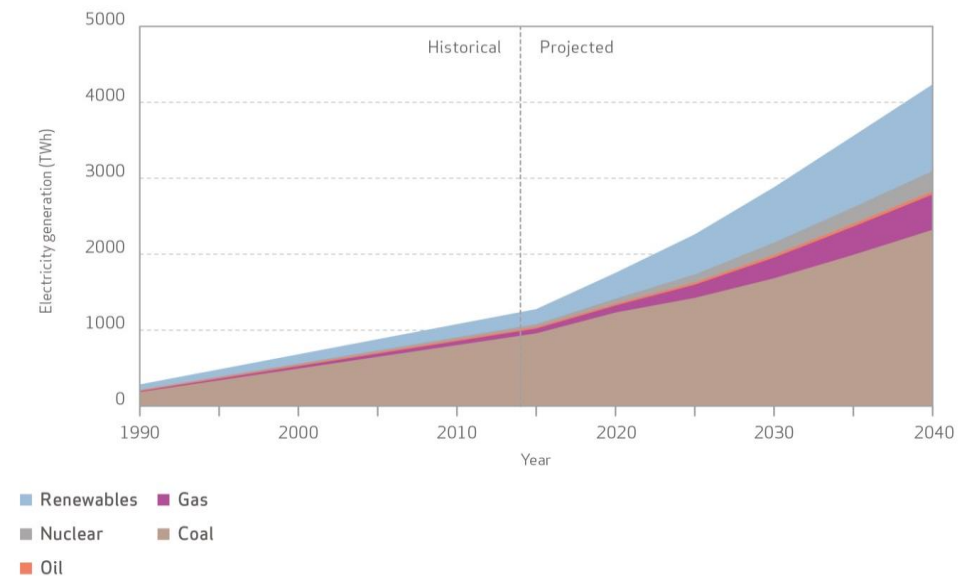
# The International Coal Industry-

## In the long-term

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- ▶ India has the potential to be the next China in terms of development.
- ▶ Coal will be the backbone of their energy supply because of the required baseload.
  - ▶ Key to the Modi government's "Make in India" campaign
- ▶ Great opportunities for exporters of coal and technology.

India's electricity generation by source in the New Policies Scenario



Source: International Energy Agency, World Energy Outlook 2016

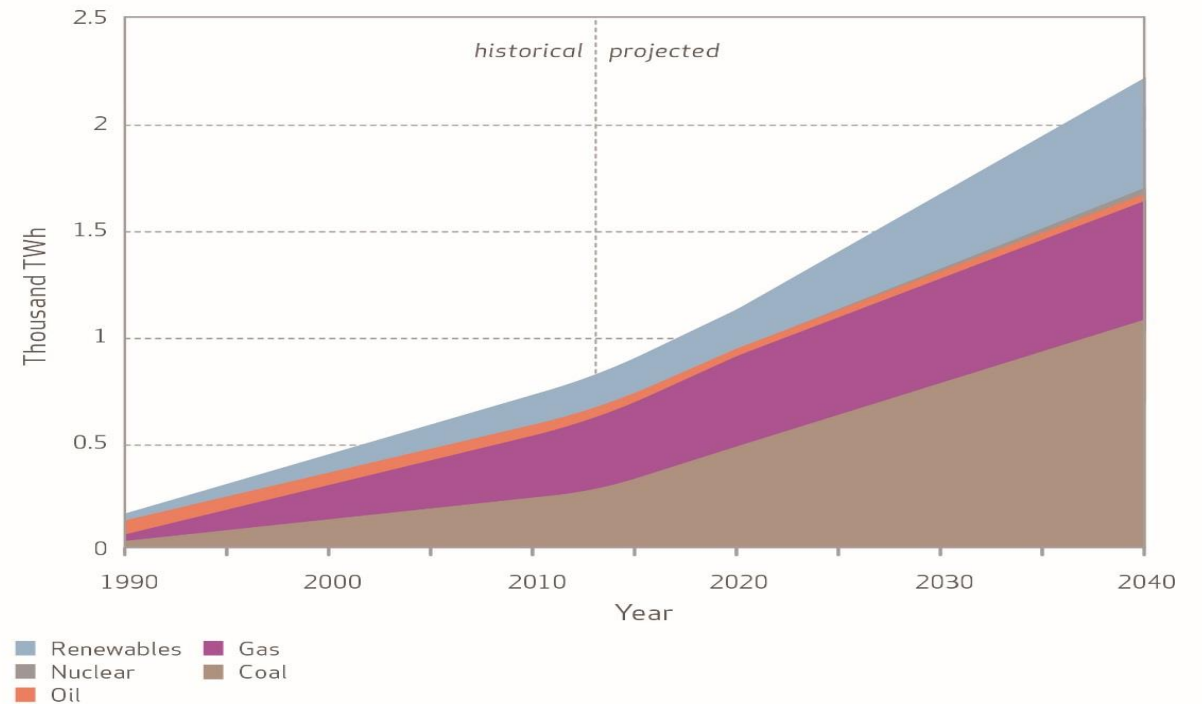


# The International Coal Industry- In the long-term

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- ▶ The whole of Southeast Asia is not any different.
- ▶ The region could possibly be the largest economic driver of the world, and consequently coal demand.
- ▶ Their domestic gas resources are showing signs of depletion, and coal exporters will need to supplement.

Southeast Asia electricity generation by source in the New Policies Scenario



Source: Adapted from IEA WEO 2015

# U.S. National Coal Council Report

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- ▶ **Coal In A New Carbon Age: Powering a wave of Innovation in Advanced Products & Manufacturing**
  - ▶ Coal offers significant potential beyond its current uses as a feedstock to fuel power plants or to produce coke used in making steel
  - ▶ Advancing new markets for coal will enhance national defense security, bolster national energy and mineral security, enhance environmental objectives and contribute to economic prosperity



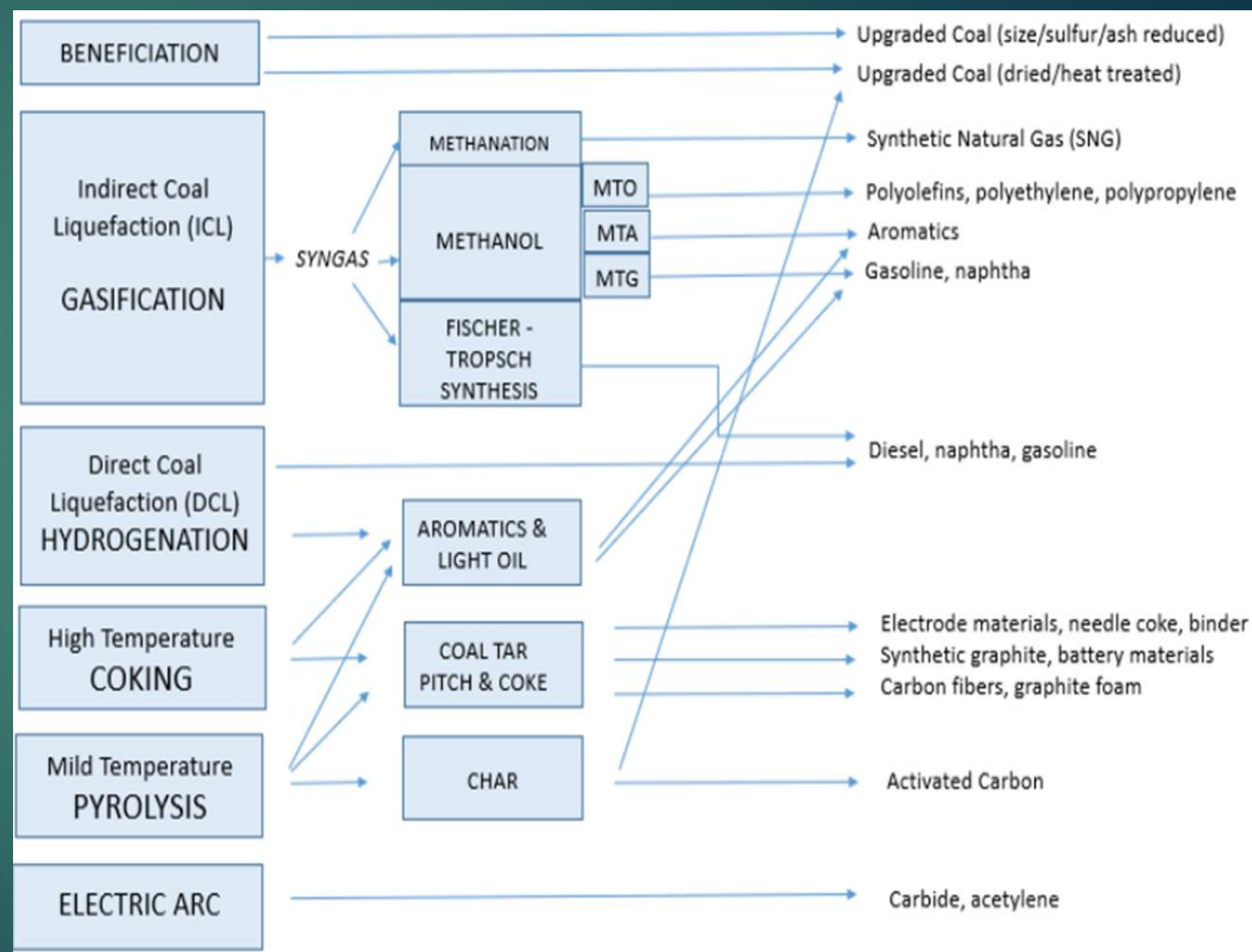


# U.S. NCC Report Findings

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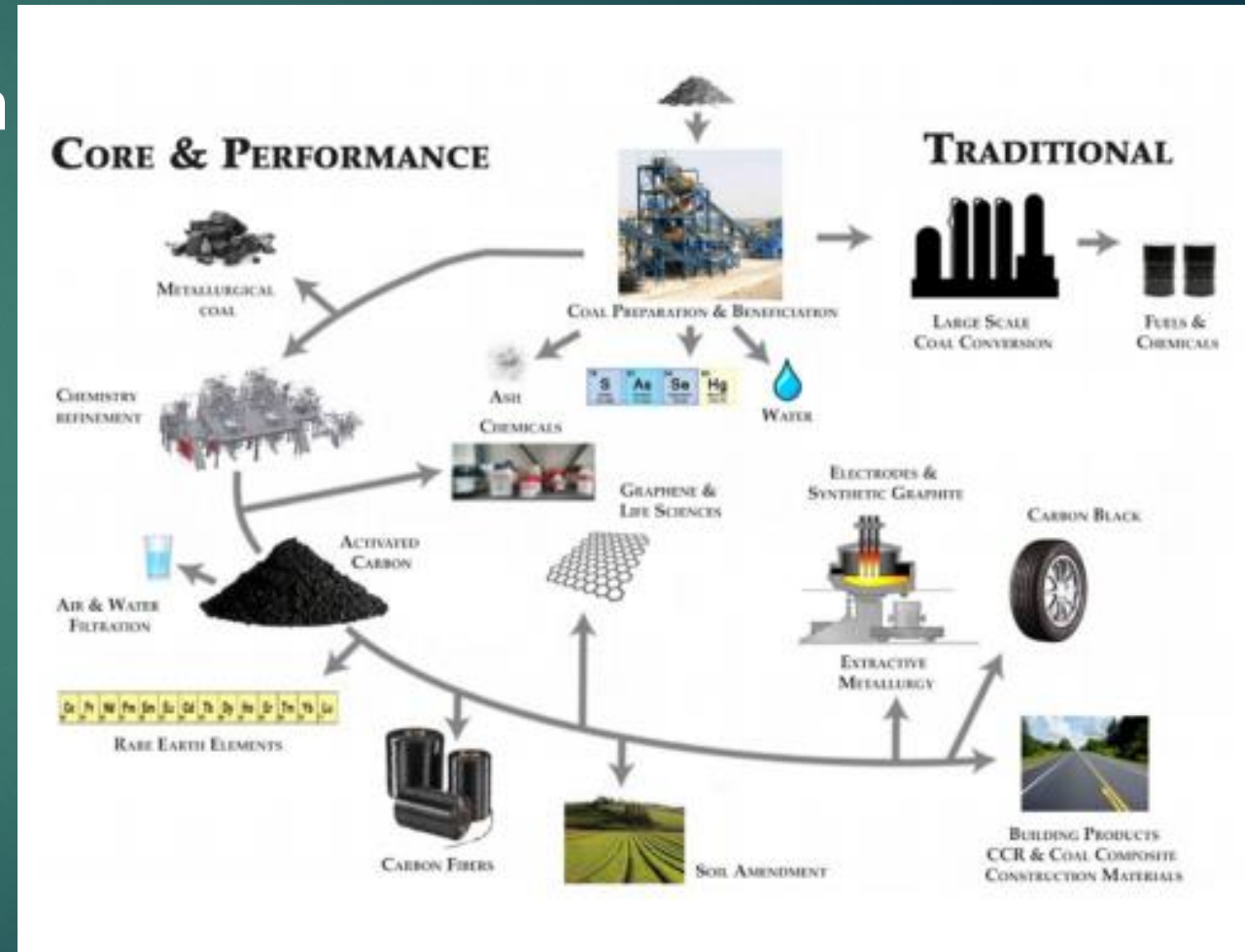
**CO2 emissions reductions can be achieved by utilizing coal :**

- ▶ **Alternative to high-emitting processes/products**
- ▶ **Durable, light-weight carbon products for aerospace and automotive industries**
- ▶ **Sorbents that capture CO2 from fossil power plants.**
- ▶ **High-strength composite materials and rare earth element components for the wind and solar power industries**



# U.S. NCC Report Recommendations 10

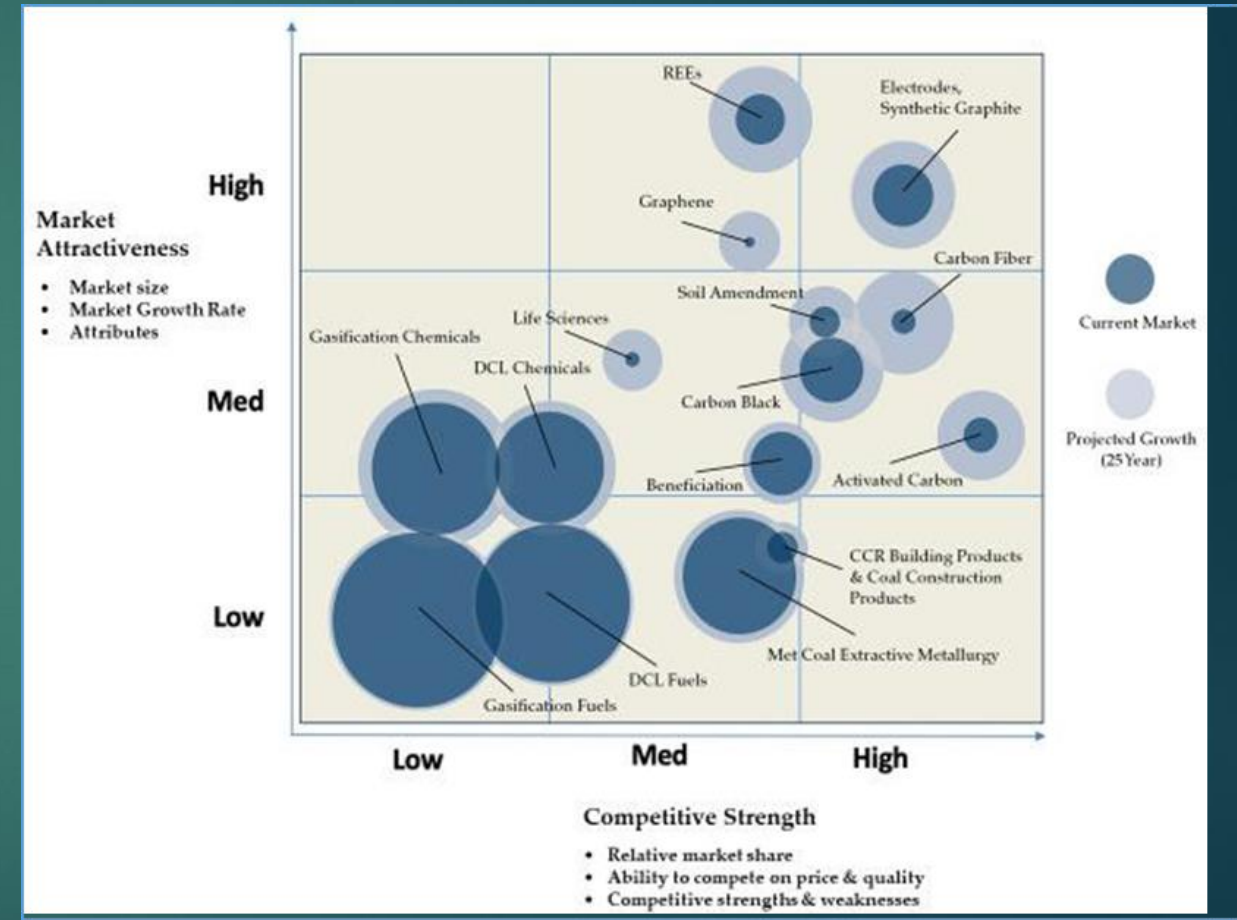
- ▶ **Coal In A New Carbon Age: Powering a wave of Innovation in Advanced Products & Manufacturing**
- ▶ Establish a focused research and development programs on coal-to-products
- ▶ Accelerate research-to-commercial deployment in coal-to-products market sectors
- ▶ Incentivize private sector investment in coal-to-products production and manufacturing sectors



# U.S. NCC Report Market Assessment

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# Opportunities within the UNECE

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## ► Cooperation in the field of chemicals production from coal.

- Example best practice opportunities
- How (CCUS) can be integrated
- Where advanced fossil fuel technologies and related energy enhancing measures can fit



# Process Categories for Chemicals Production from Coal

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- ▶ **Thermal Processing  
(Carbonization)**
- ▶ **Syngas-Based Processes**
- ▶ **Chemical Extraction**





# Thermal Processing (Carbonization)

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- ▶ **Coke Plants**
- ▶ **Refinery Cokers**
- ▶ **Byproduct Gases can be Used in Advanced Gas Turbines for Combined Cycle Cogeneration**



# Syngas-Based Processes

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- ▶ Fischer-Tropsch Synthesis
- ▶ Methanol
- ▶ Ammonia
- ▶ Another Opportunity for Cogeneration with Advanced Gas Turbines
- ▶ Processes can Produce Concentrated CO<sub>2</sub> Stream for Enhanced Oil Recovery



# Chemical Extraction Processes

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- ▶ **Similar to Direct Coal Liquefaction**
- ▶ **Cogeneration Opportunity**





# Best Practices Opportunities: Heat Integration and Emissions Reduction

- ▶ **Application of State-of-the-Art Gas Turbines to use Byproduct Gases for CHP/Cogeneration**
- ▶ **Application of Advanced Compressor Technologies**



# Best Practices Opportunities: CCUS Integration

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- ▶ **CO<sub>2</sub> from Syngas-Based Processes for EOR Applications**





# Moving Forward

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## Recommendation: Convene a Panel of Experts on the Chemicals Topic for:

- ▶ The views of the members on opportunities
- ▶ A set of technologies that are of interest to the group.
- ▶ The state of technology transfer within the UNECE group, and recommendations for improvements.
- ▶ A set of recommendations for overcoming barriers to deployment of advanced chemicals technologies in UNECE member countries.



# U.S. National Coal Council Report

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The National Coal Council Report

<https://www.nationalcoalcouncil.org/>

Under “studies”



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