COAL PHASE-OUT PLANS ANNOUNCED, BUT MARGINAL COMPARED TO TOTAL CAPACITIES

Announced coal phase-out year and total coal capacity to be decommissioned

Global gross operating coal capacity: 2,015 GW*

Countries with phase-out plans but no coal-fired units above 30 MW are not indicated, those include: Angola, Belgium, Costa Rica, El Salvador, Ethiopia, Fiji, Latvia, Liechtenstein, Lithuania, Luxembourg, Marshall Islands, Niue, Switzerland, Tuvalu, Vanuatu

Carbonbrief 2019, Government of Canada 2019, Powering Past Coal Alliance 2018, Europe Beyond Coal 2018

*Status: January 2019, includes units above 30 MW
AT THE SAME TIME: NEW COAL-FIRED CAPACITIES IN THE MIDDLE EAST AND AFRICA HAVE BEEN ANNOUNCED

Coal generation capacities in selected countries in Middle East & Africa

- Targeted
- Announced
- In construction
- In operation

THE EXPANSION OF COAL-FIRED POWER GENERATION IS INCOMPATIBLE WITH GLOBAL CLIMATE PROTECTION EFFORTS

What are the motivations to introduce/add coal-fired power generation?

Study for GIZ “DIAPOL-CE Policy dialogue and knowledge management on low emissions development strategies in the MENA region”

Commissioned by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

(forthcoming)
Aim of study
• Policy recommendations and narrative in favor of alternative pathways
• Provide factual basis on planned and existing coal-fired capacity in the MENA region
• Model various long-term capacity expansion scenarios

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COAL HAS PLAYED A MINOR ROLE IN THE REGION; ENERGY SECURITY CONCERNS AND RISING DEMAND HAVE BROUGHT IT TO THE AGENDA (III/III)

<table>
<thead>
<tr>
<th>Country</th>
<th>Current role of coal</th>
<th>Motivations</th>
<th>Outlook</th>
</tr>
</thead>
</table>
| Senegal       | Minor role: 141 MW in operation | • Dependency from fuel imports  
• **Diversification of energy mix**  
• Security of supply | • Two 300-MW coal projects likely to be shelved  
• Government plan: 850 MW by 2035 |
| Ivory Coast   | No coal in electricity generation so far  
No domestic coal production | • Shortages in gas supply  
• Diversification  
• **Extension of capacity to become energy hub**  
• Growing demand | • San Pedro plant (1.4 GW) announced, later reduced (0.7 GW). Under construction |
| South Africa | Power mix share of 85%  
Fifth-largest coal exporter | • 10th largest coal reserves worldwide  
• Cost competitiveness  
• **Contributor to economy and employment** | • Decommission of 12 GW of coal capacity by 2030 (41% in total power) and 35 GW by 2050 (11% in total power) |
COAL HAS PLAYED A MINOR ROLE IN THE REGION; ENERGY SECURITY CONCERNS AND RISING DEMAND HAVE BROUGHT IT TO THE AGENDA (I/III)

<table>
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<tbody>
<tr>
<td><strong>Iran</strong></td>
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</table>
| • Minor role (only small industrial site) | • **Opportunity cost of gas (vs. exports)**  
  • Local value creation through coal  
  • Complications with RES due to sanctions | • Tabas power plant “under construction” for ~10 years. Might be abandoned. |
| **Oman**             |             |         |
| • Earlier coal plants halted  
  • Share of coal in long-term mix discussed | • Industrial development (diverting gas to industry)  
  • Opportunity cost of gas (vs. exports)  
  • Security of supply | • 1.2 GW Duqm plant still discussed  
  • RES and improved interconnections could delay coal expansion |
| **UAE**              |             |         |
| • No coal in power mix so far  
  • Target: 12% of capacity by 2050 | • **Decreasing available gas resources**  
  • Diversification  
  • Very high standards for security of supply | • Hassyan 2.4 GW under construction. Additional 1.2 GW possible.  
  • Improved trade, RES and overcapacity could delay coal expansion |

Personal communication with local stakeholders between June and September 2018
### Current role of coal

<table>
<thead>
<tr>
<th>Country</th>
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</table>
| Morocco     | • Power mix share of > 50%  
              • 1.4 GW online since late 2018                                         |
| Egypt       | • Target: 16.8 GW coal by 2030  
              • Hamarawein project of 6 GW awarded at $5.4ct/kWh                     |
| Jordan      | • Minor role: 30 MW Qatraneh plant operational  
              • Target: 5% coal goal by 2025                                           |

### Motivations

<table>
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</table>
| Morocco     | • Growing demand  
              • Cost competitiveness  
              • Insufficient domestic fossil fuel supply                                |
| Egypt       | • Secure supply to industry  
              • Growing demand  
              • Industrial development (diverting gas to petrochemicals, fertilizers) |
| Jordan      | • Lack of indigenous fossil fuel resources  
              • Secure supply to industry  
              • Population increase                                                    |

### Outlook

<table>
<thead>
<tr>
<th>Country</th>
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<tbody>
<tr>
<td>Morocco</td>
<td>• 1.32 GW planned (Nador) currently on hold due to opposition &amp; port logistics</td>
</tr>
</tbody>
</table>
| Egypt       | • Financial guarantees for 6 GW Hamarawein announced  
              • PPA for 2.6 GW Ouyan Moussa plant announced ($4ct/kWh)                  |
| Jordan      | • No concrete additional coal plans announced                                |

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Personal communication with local stakeholders between June and September 2018
Develop long-term energy strategies that mitigate investor risk

Global trend toward decarbonization is well underway and poses a substantial risk of stranded investments for investors in coal-fired power generation.

Introduction of CO₂-prices in different forms can lead to a lower utilization of coal-fired generation.

Public opposition against coal projects is becoming an increasing investor risk.
Take advantage of declining costs for renewables and consider externalities of coal-fired generation

- MENA region and Middle East is uniquely positioned to benefit from already low and declining costs of RES

- Externalities such as pollution, public health threats and import dependence should be considered

- Cost of energy systems can be reduced without coal even further, e.g. by tapping into preferential funding available from multilateral banks
Build flexible power systems that can accommodate renewables most efficiently

Growing energy demand in the investigated countries requires investments in electricity systems.

Investments should be made in the perspective of enhancing flexibility to accommodate variable renewables in a cost-efficient manner.

Flexible power systems will increase reliability of supply and make energy systems proof for future challenges.
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