



Organizado em parceria com:



CICLO DE DEBATES PARA A TRANSIÇÃO ENERGÉTICA

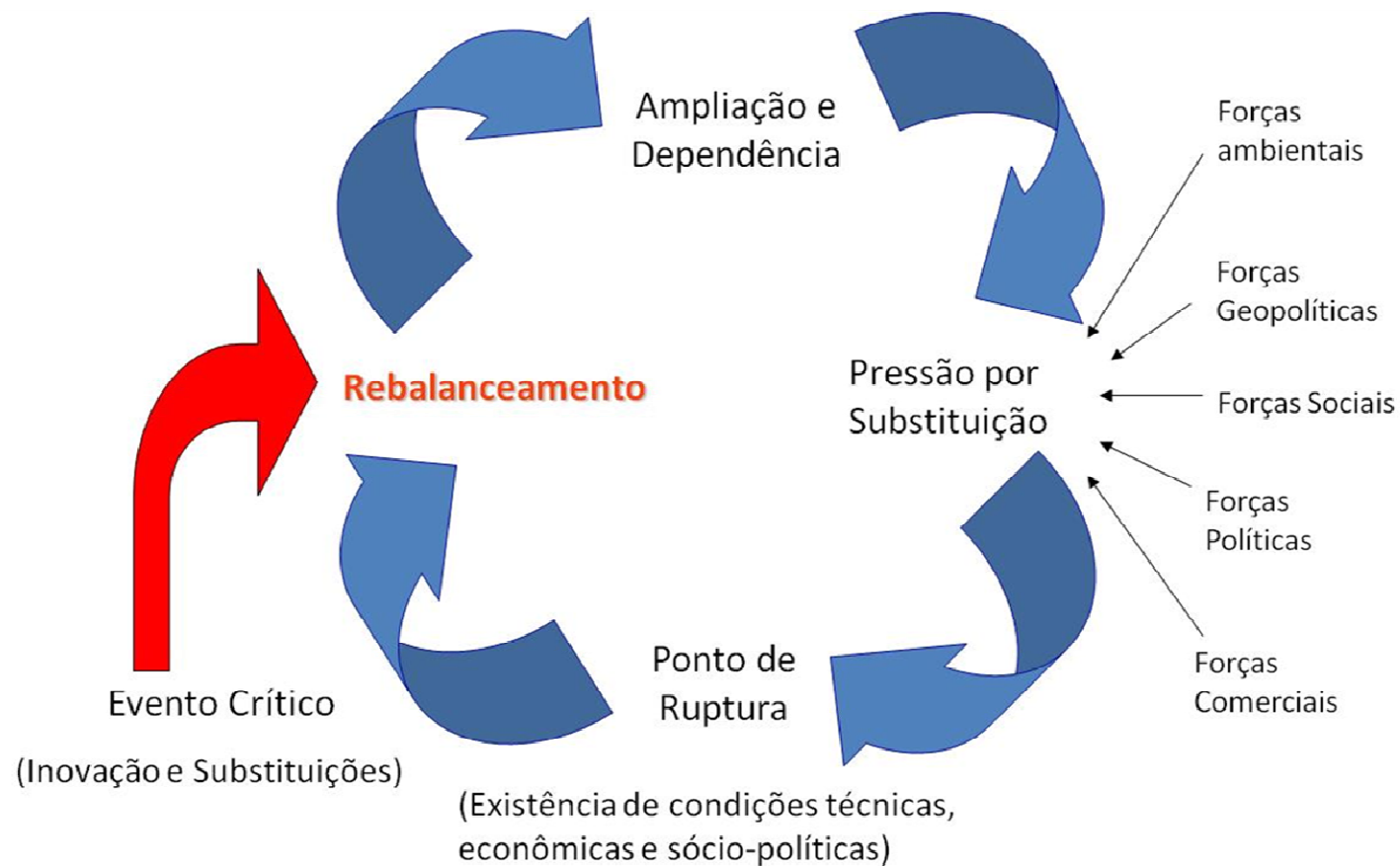
Geopolítica de Energia

Giovani Machado

Superintendente de Gás Natural e Biocombustíveis da EPE

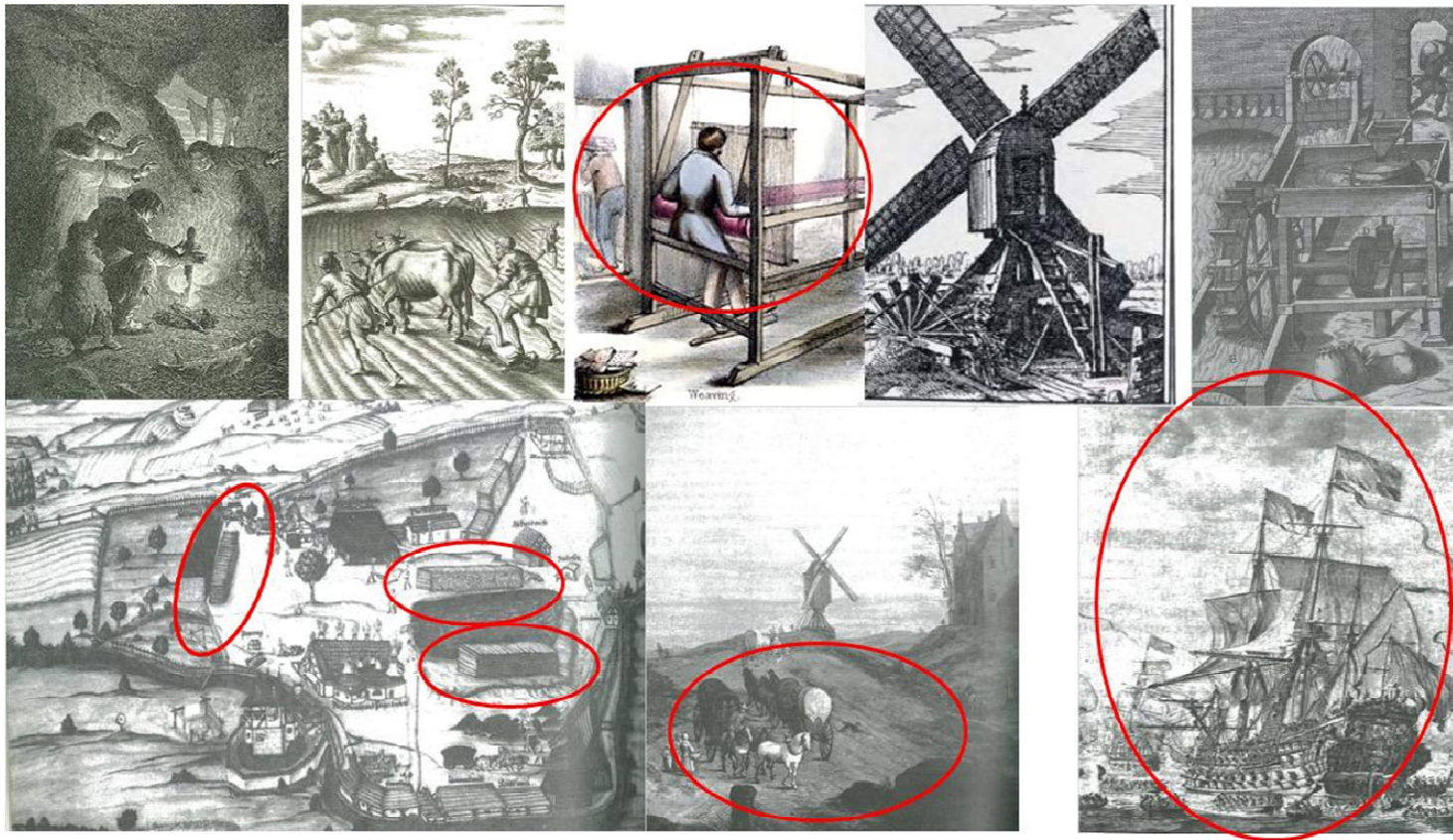
Transição Energética

Dinâmica de substituição fonte-conversor



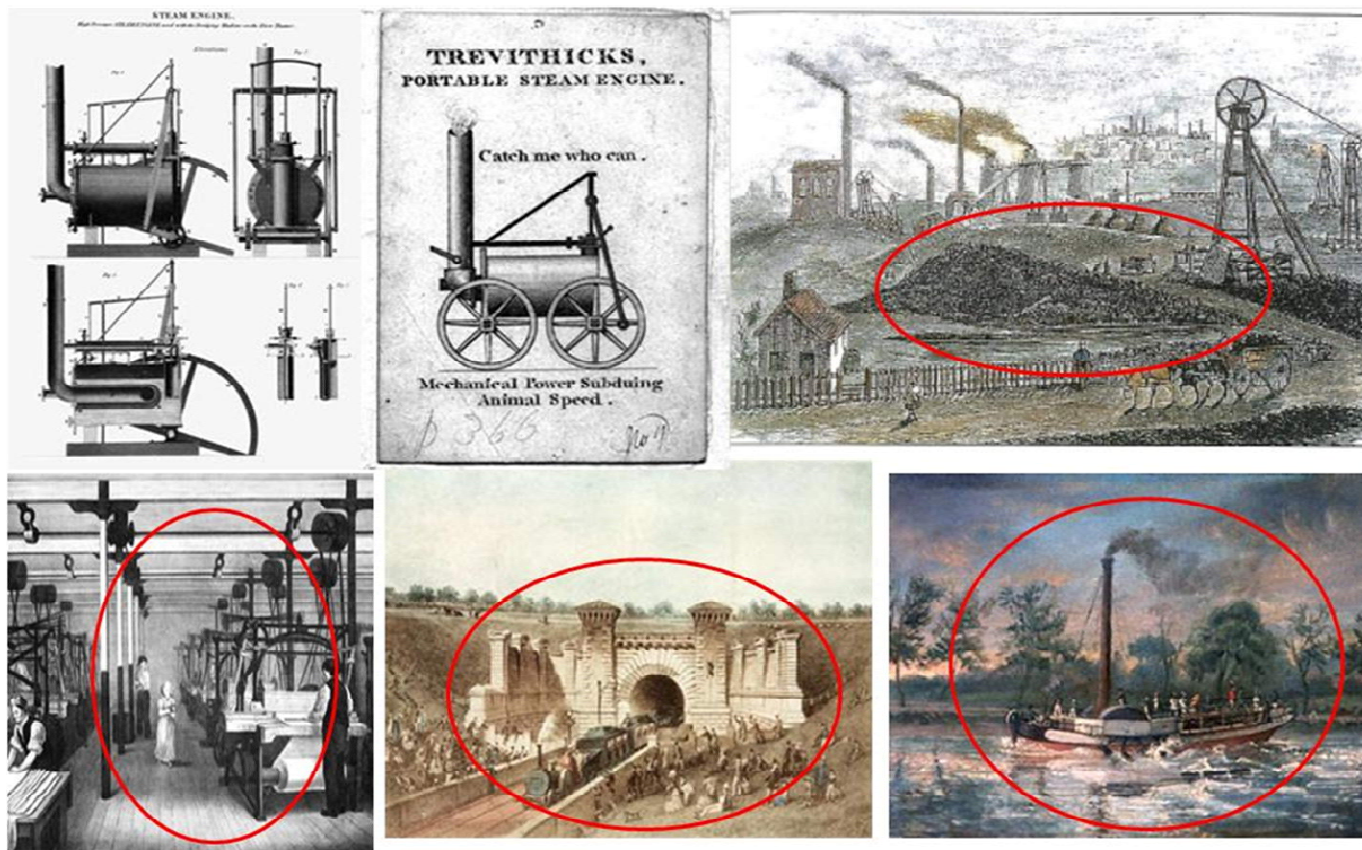
Pré-Revolução Industrial

Biomassa, tração animal e forças da natureza



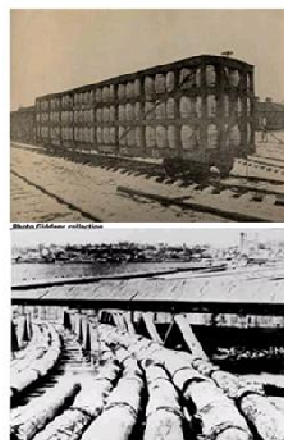
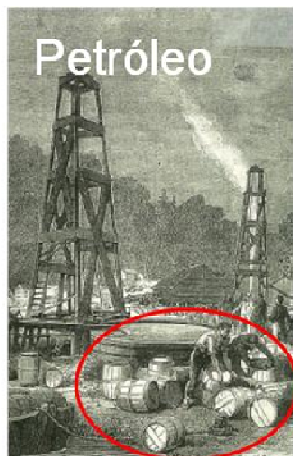
1ª Revolução Industrial

Carvão mineral e máquina térmica

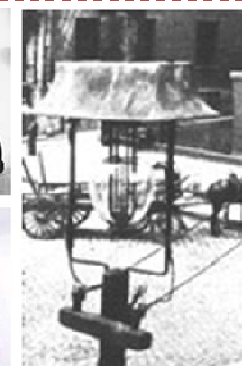
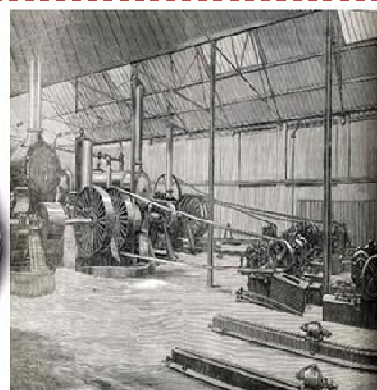
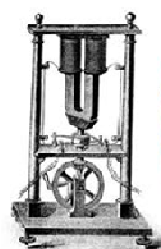


2ª Revolução Industrial

Petróleo e combustão interna / eletricidade e dínamo

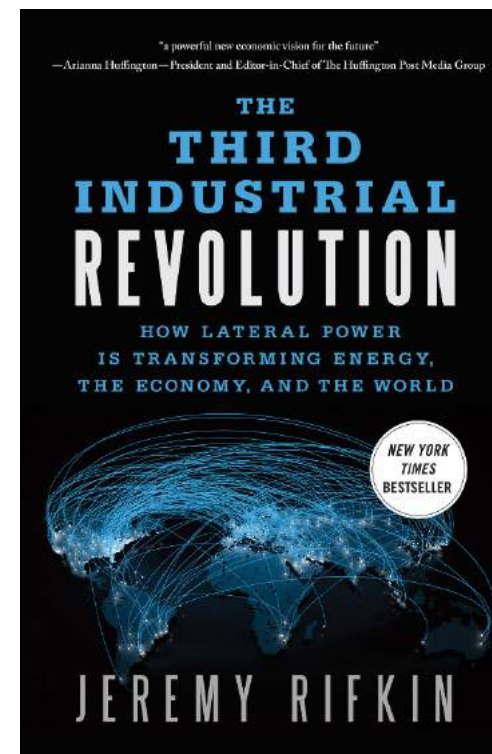
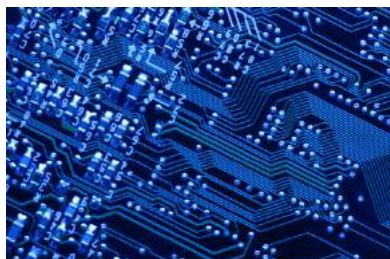


Eletricidade



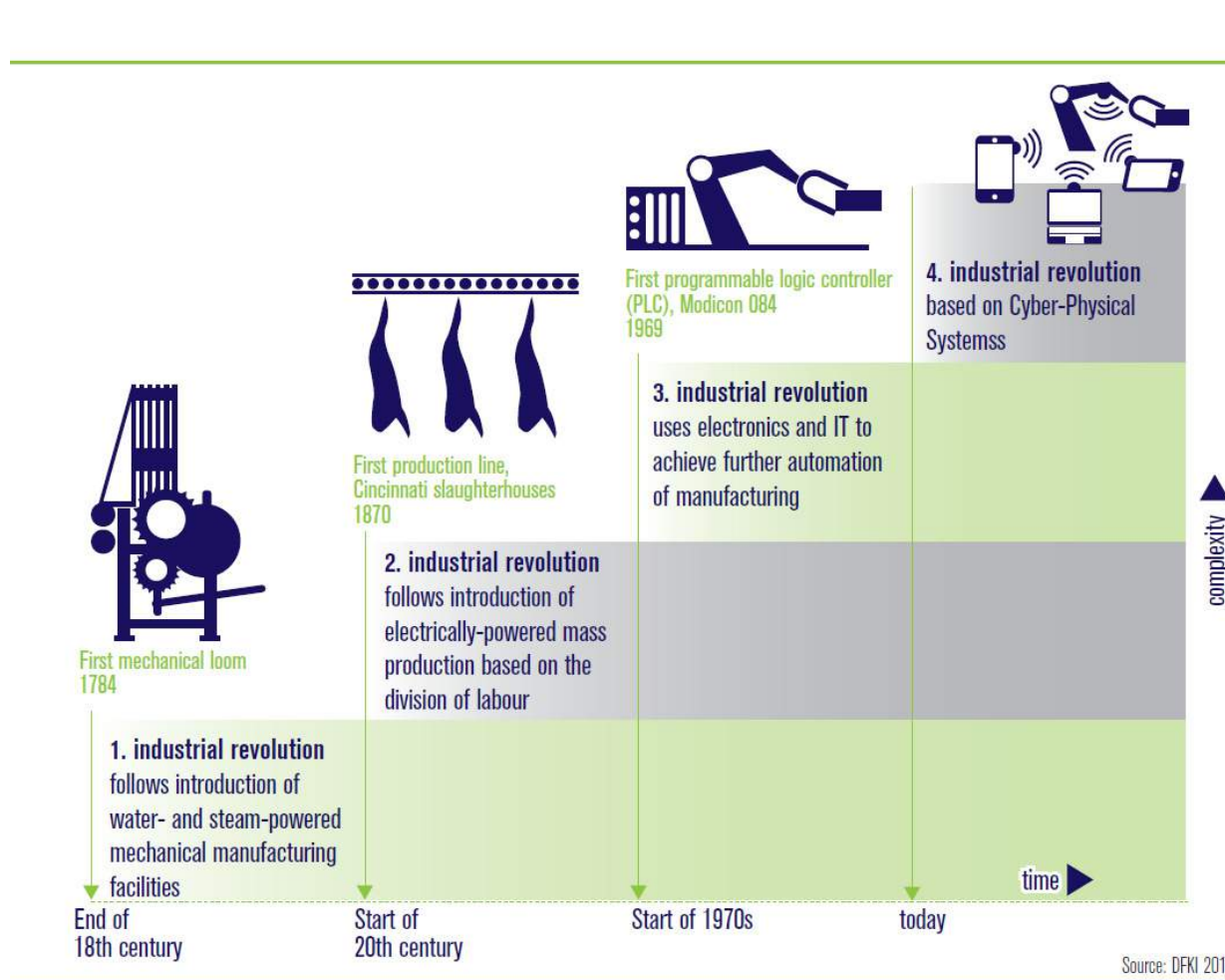
3ª Revolução Industrial

Eletricidade e chip (eletromecânica-eletrônica)

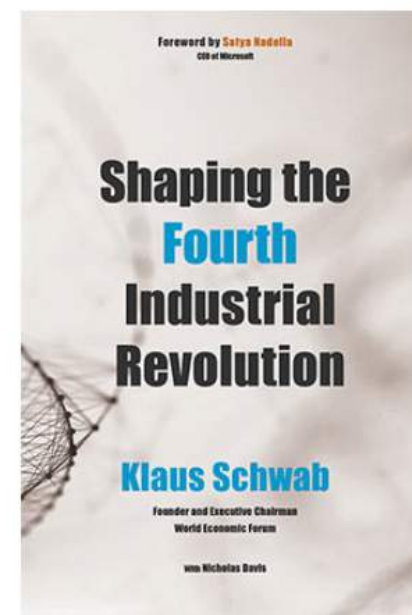


4ª Revolução Industrial

Eletricidade, Eficiência e a Era Digital

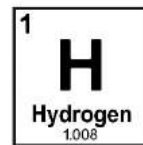
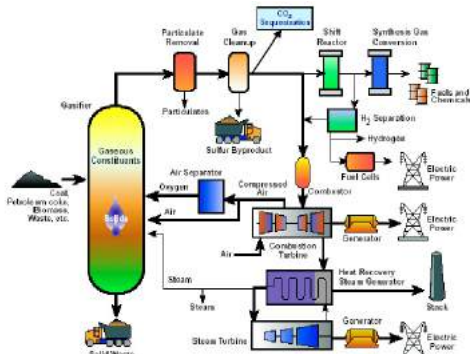
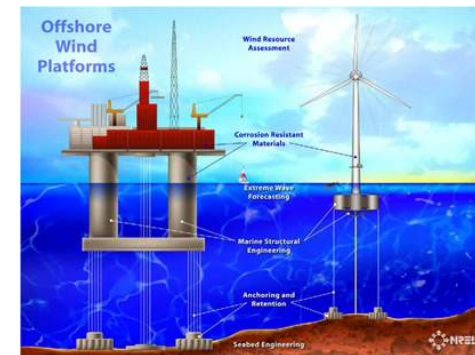
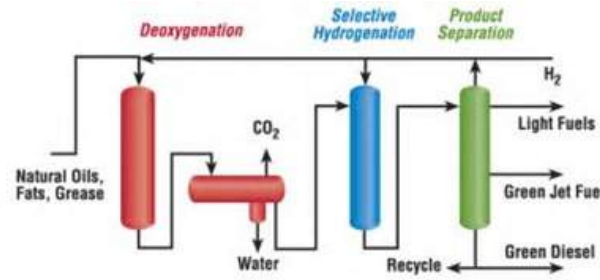
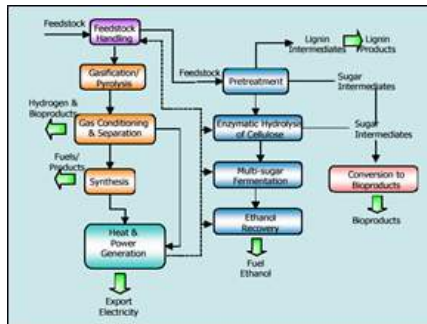
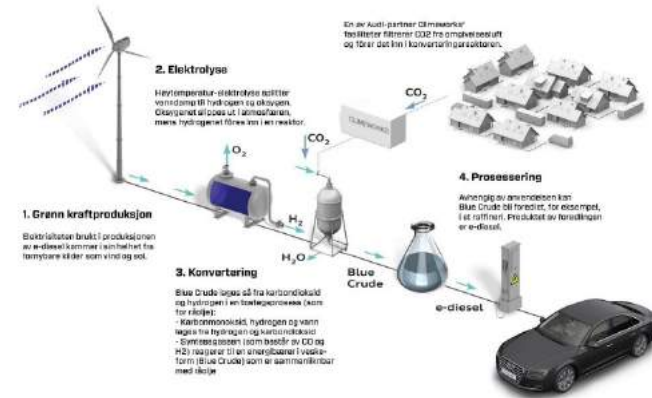
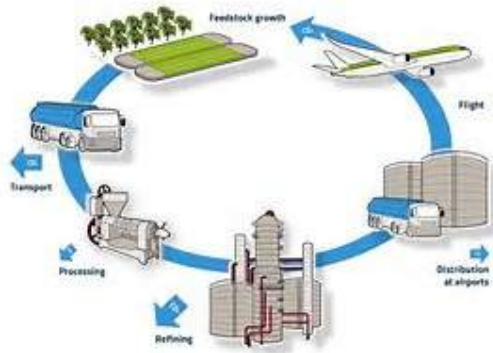


← Energia Primária?

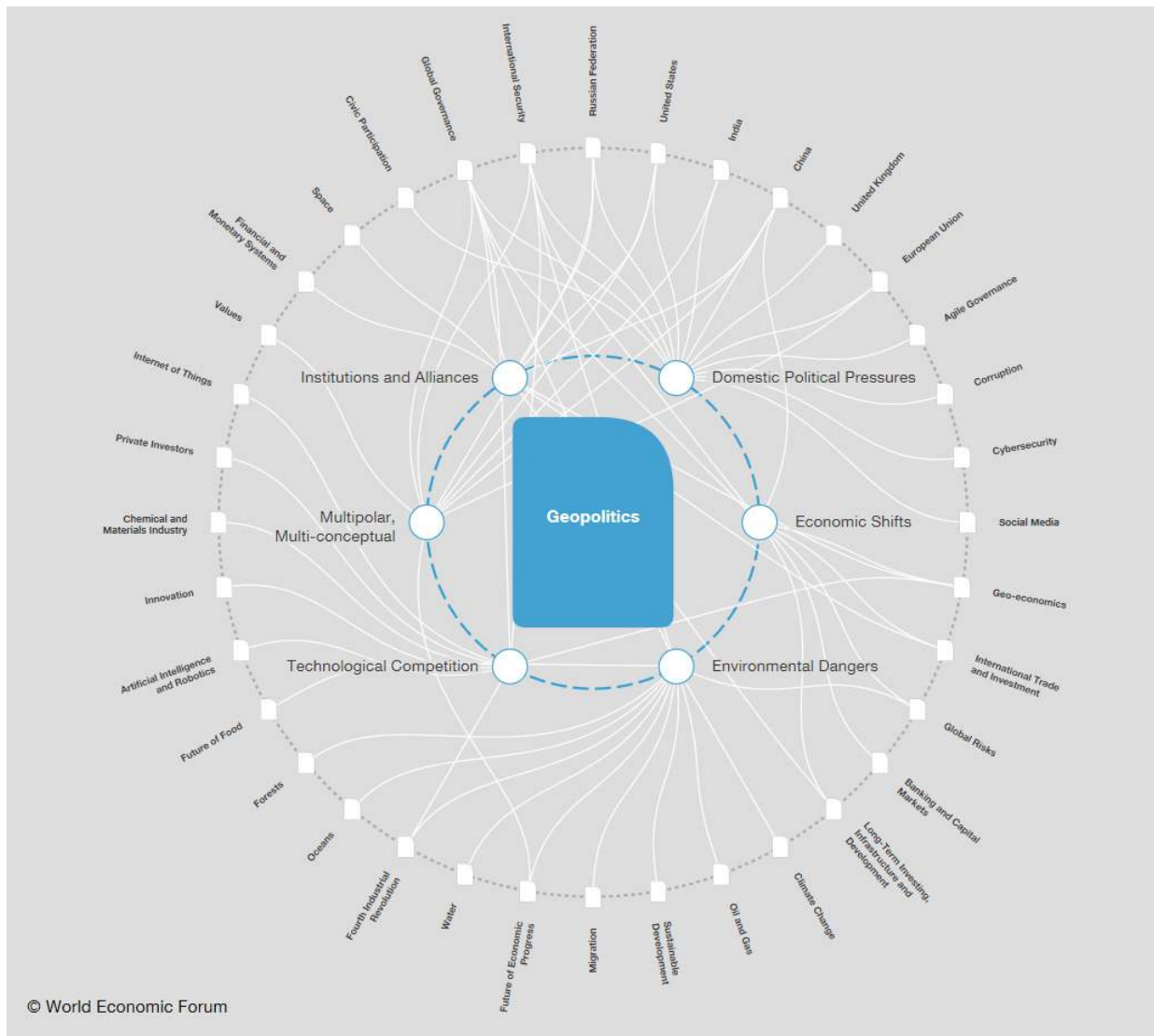


4ª Revolução Industrial

Eletricidade, Renováveis, Eficiência, Gás, Sintéticos...



Geopolítica e Energia

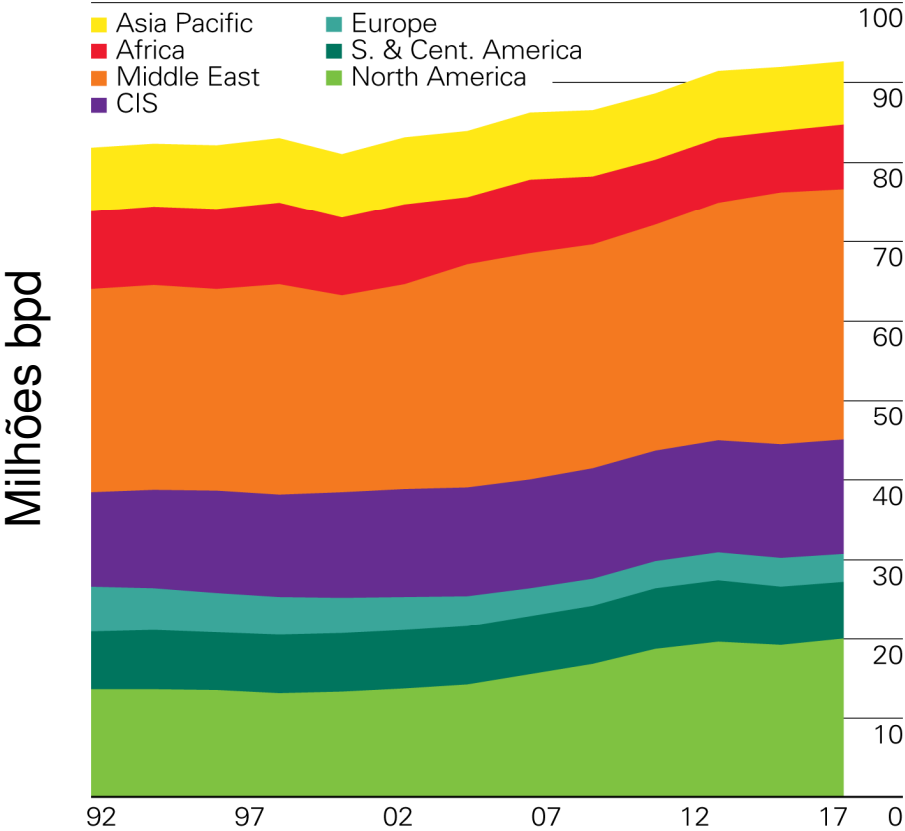


- Poder, ordem e apropriação da riqueza
- Deterioração da ordem internacional pós-guerra
- Fragmentação de interesses e cooperação
- Dissensos e tensões
- Novos riscos e temas que requerem cooperação
 - Mudanças climáticas
 - Comércio e Investimento
 - Segurança
 - Outros

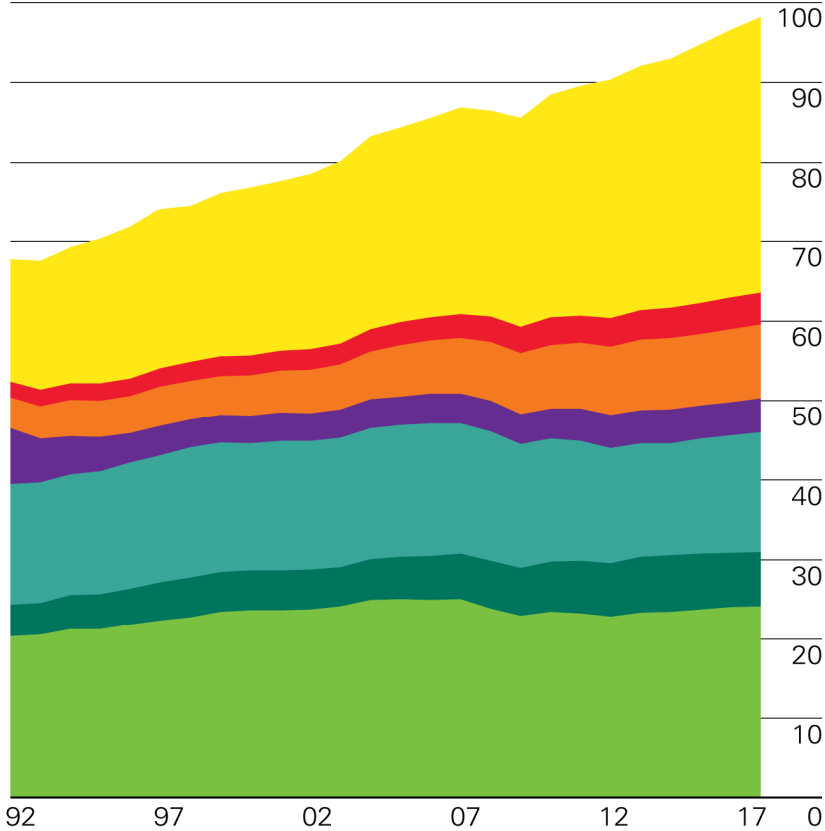
Petróleo

Mercado e sua geopolítica

Produção



Consumo



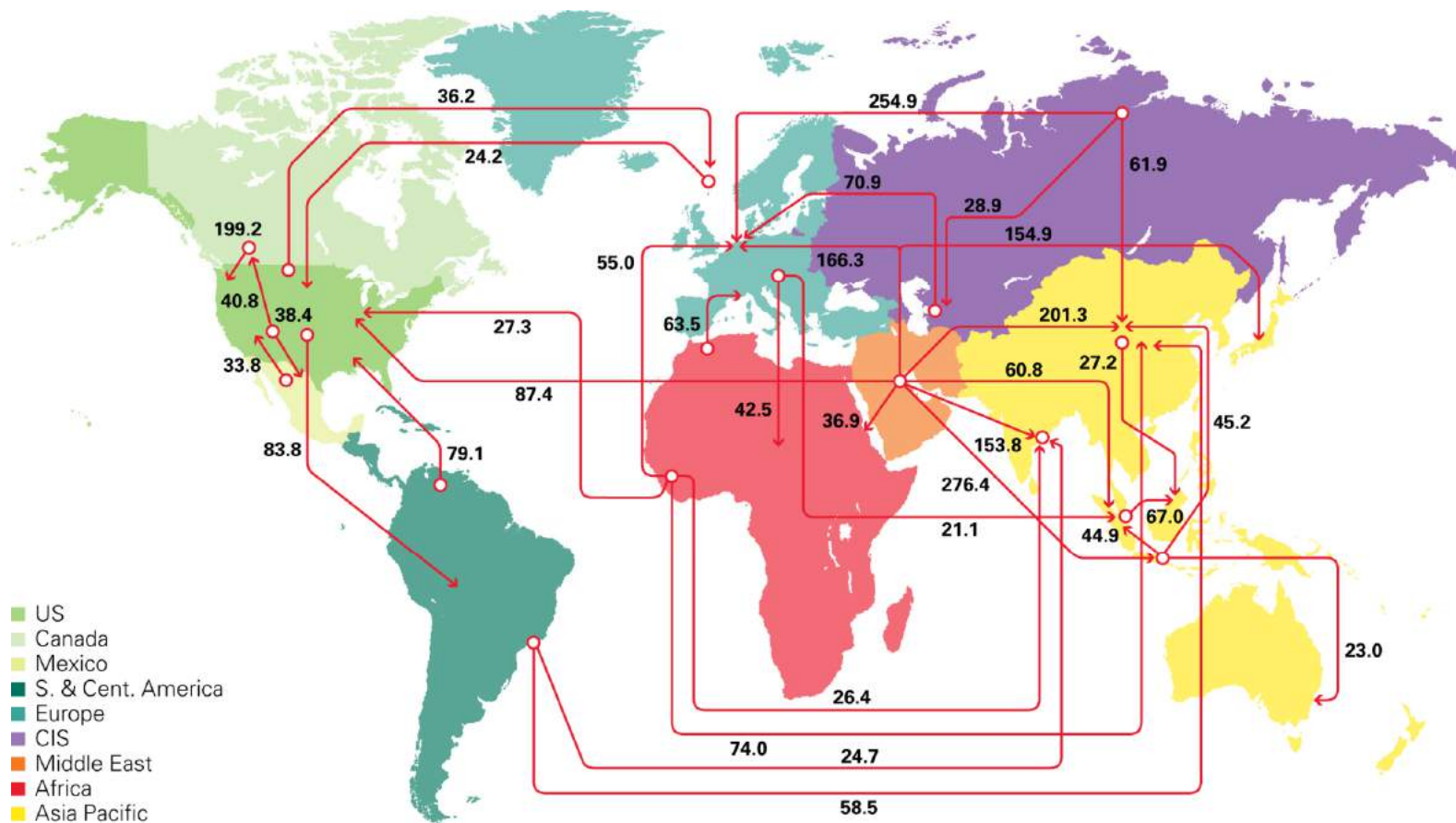
BP Statistical Review of World Energy 2018
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Petróleo

Principais fluxos comerciais - 2017

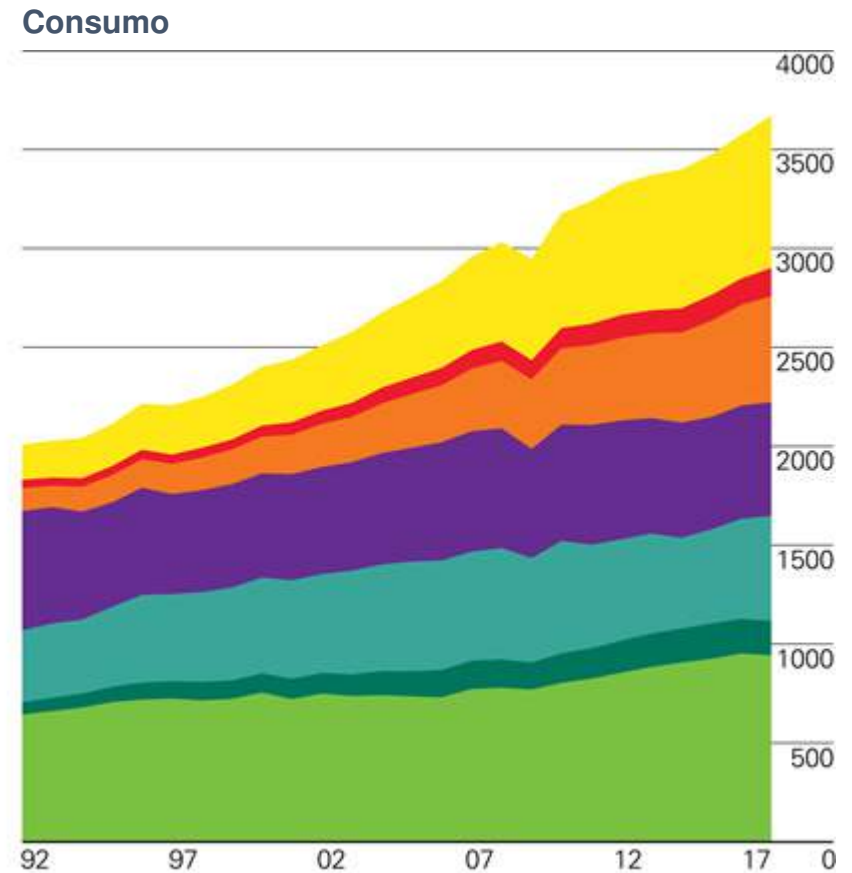
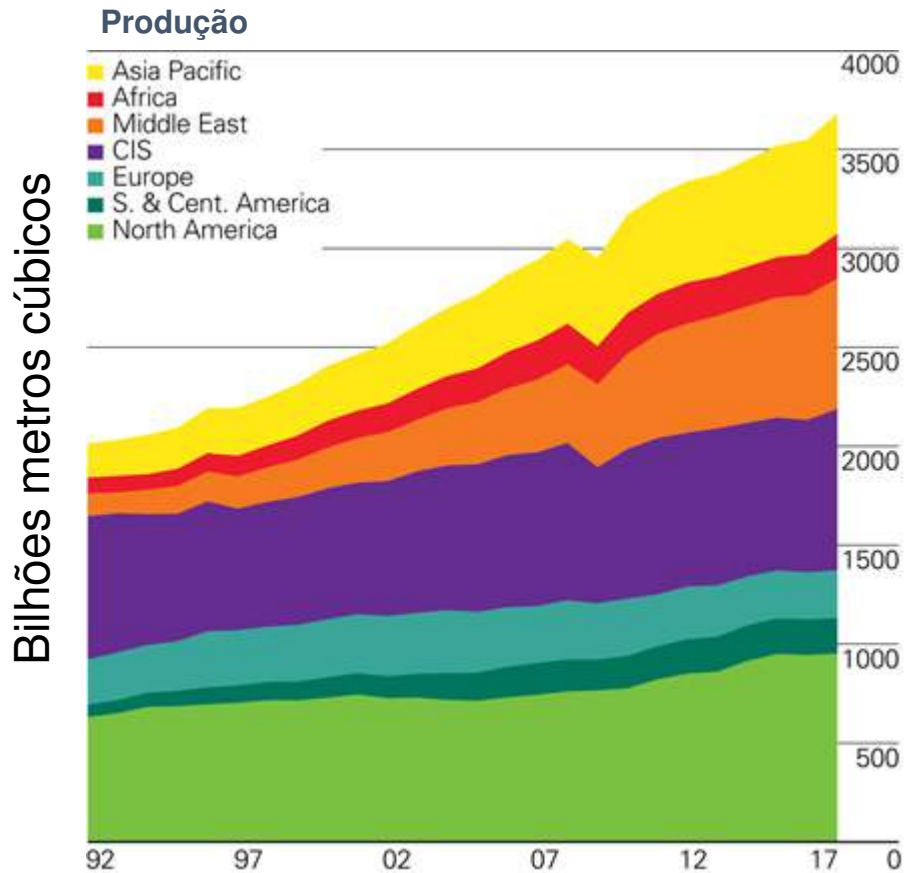
Milhões toneladas



BP Statistical Review of World Energy 2018
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Gás Natural

Mercado e sua geopolítica

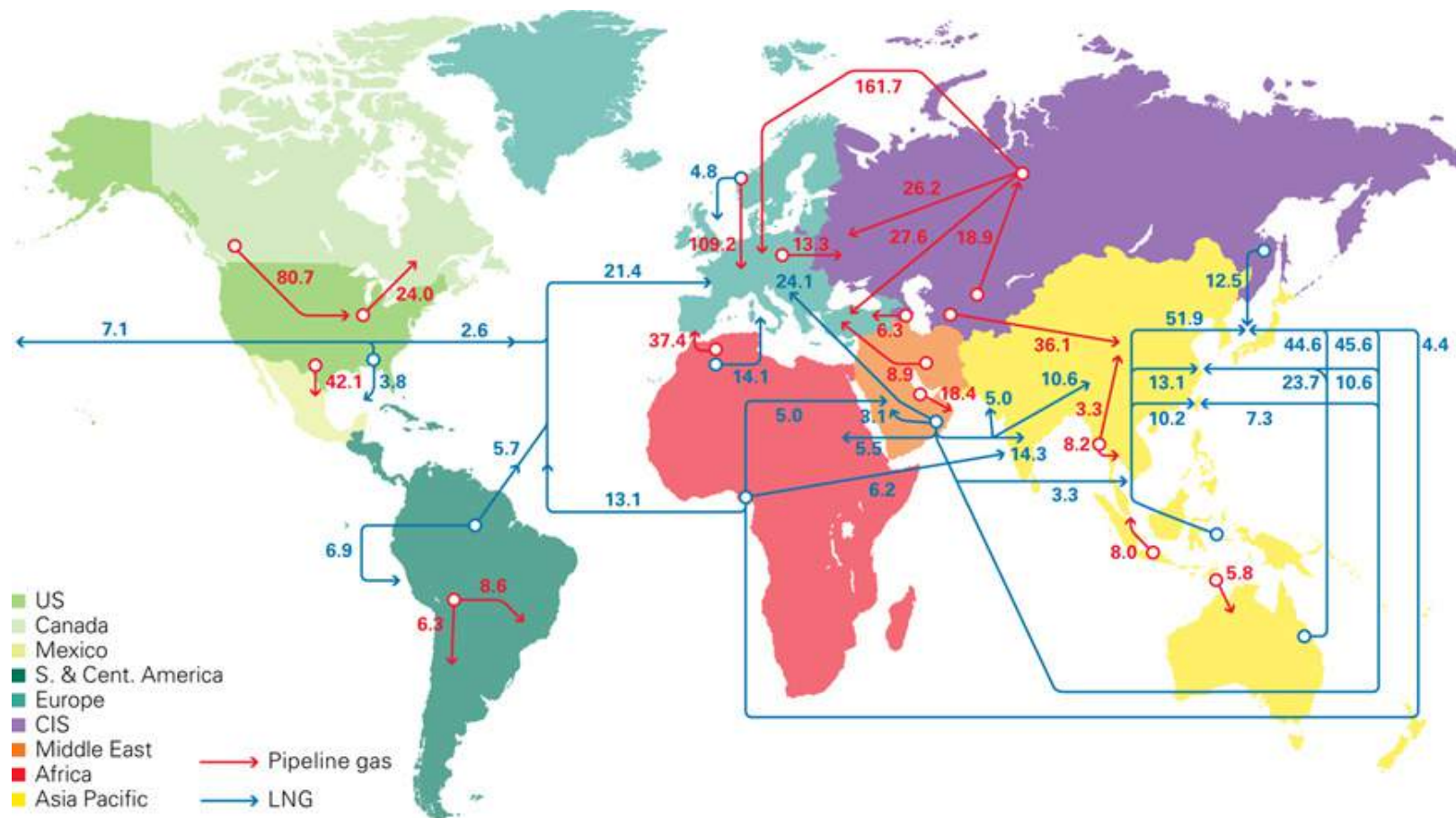


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Gás Natural

Principais fluxos comerciais - 2017

Bilhões metros cúbicos

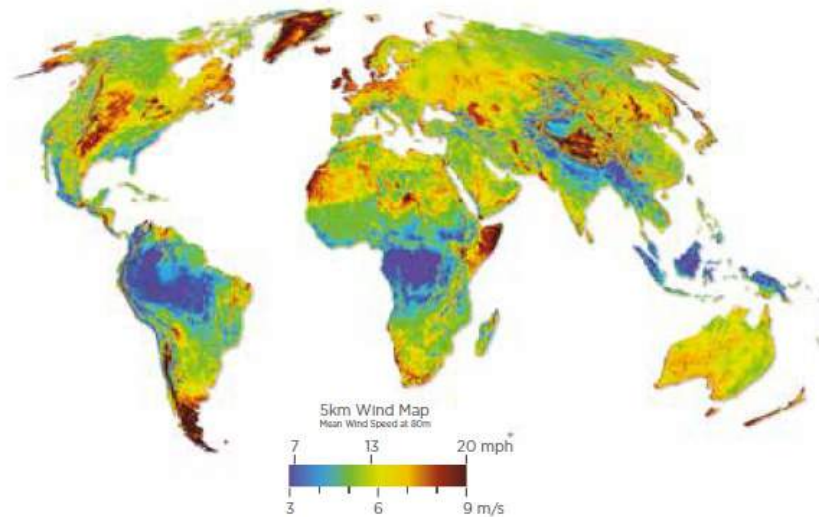


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Novas Renováveis

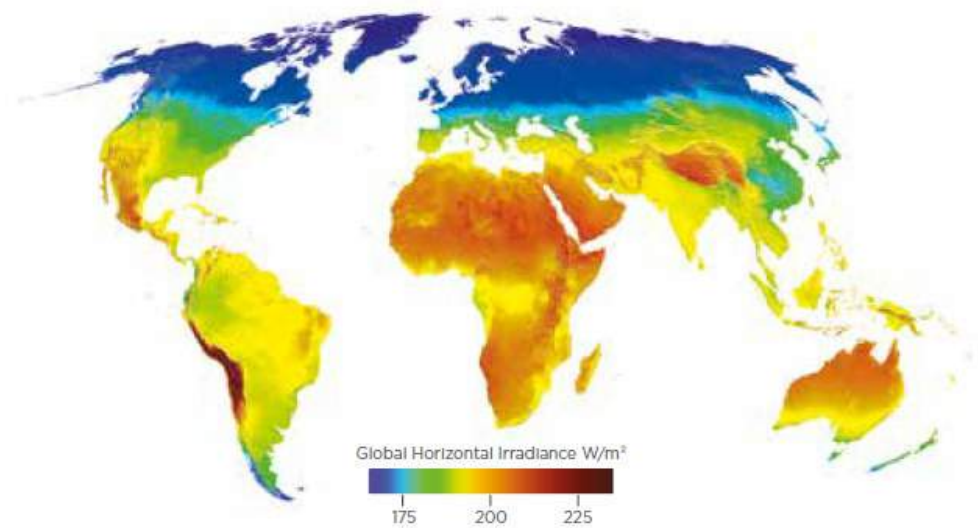
Segurança energética e apropriação de riqueza

Potencial Eólico Mundial



Source: Vaisala.

Potencial Solar Mundial



Source: Vaisala.

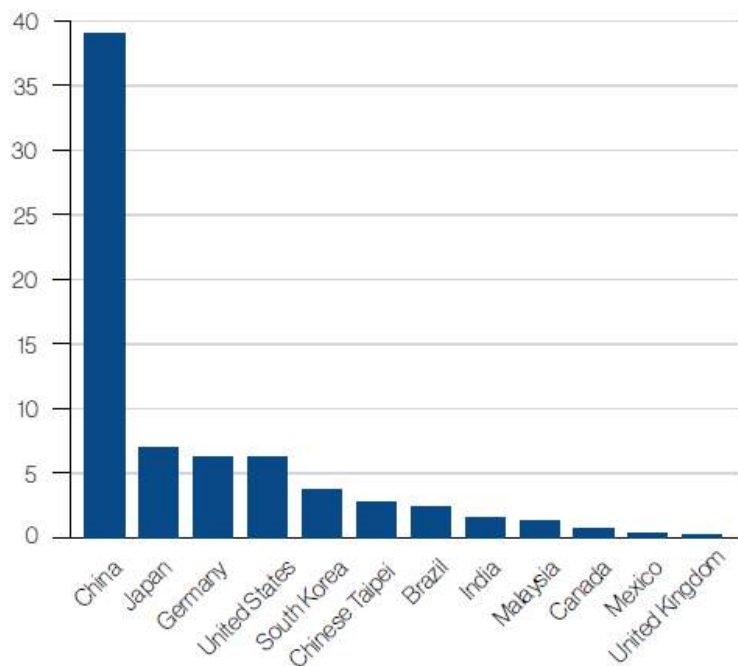
IRENA (2019). A New World: The Geopolitics of Energy Transformation. Global Commission on the Geopolitics of Energy Transformation (IRENA, Federal Foreign Office, Norwegian Ministry of Foreign Affairs).



Novas Renováveis

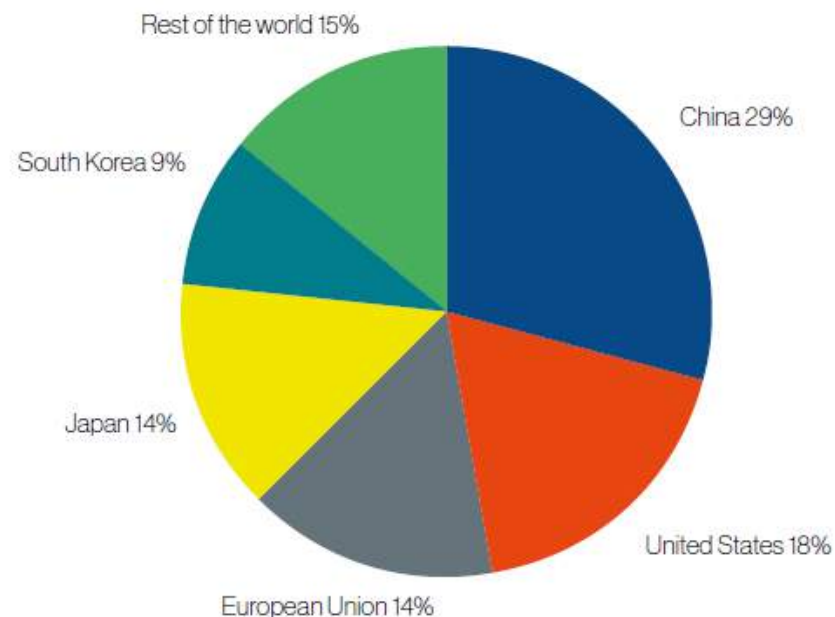
Segurança energética e apropriação de riqueza

Valor adicionado da indústria de novas renováveis (2014 US\$ bilhões)



Source: Clean energy manufacturing analysis center.⁷⁸

Participação cumulativa em patentes de novas renováveis – Final 2016



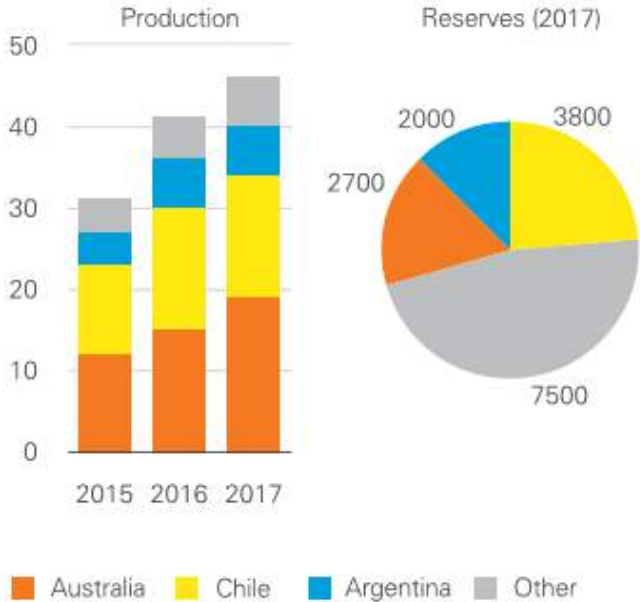
Source: IRENA.

IRENA (2019). A New World: The Geopolitics of Energy Transformation. Global Commission on the Geopolitics of Energy Transformation (IRENA, Federal Foreign Office, Norwegian Ministry of Foreign Affairs).

Nova geopolítica?

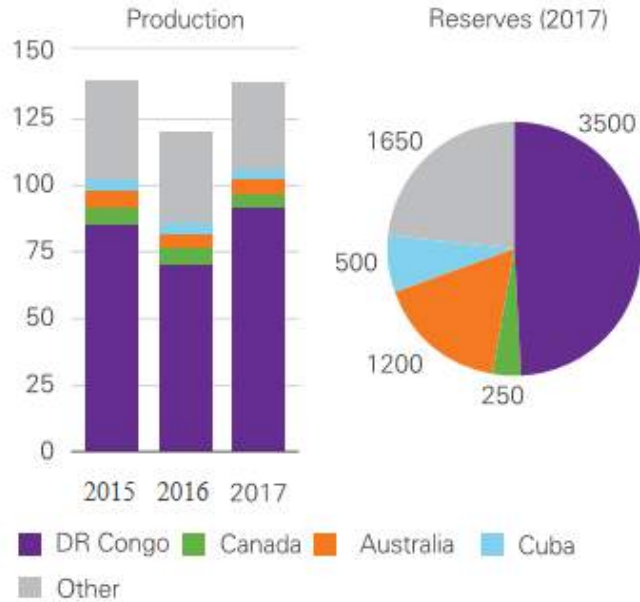
Elementos para baterias

Lithium production and reserves (thousand tonnes)



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Cobalt production and reserves (thousand tonnes)



Geopolítica da Energia

Considerações finais

- Geopolítica: segurança energética e apropriação de riqueza
- Petróleo
 - geopolítica dura, novos entrantes e retornos
- Gás Natural
 - combustível da transição
- Novas renováveis e eletrificação
- 4ª Revolução Industrial: a Era Digital
- Geografias da política e da Economia: Nova (Des)ordem?
- Implicações para o Brasil

Giovani Machado

Superintendente de Gás Natural e Biocombustíveis

Obrigado!

MINISTÉRIO DE
MINAS E ENERGIA



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