Implantação e Operação de Projetos de Hidrogênio Verde no Brasil

SENADO FEDERAL

CEHV

Comissão Especial para Debate de Políticas Públicas sobre Hidrogênio Verde

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Projetos de H2V em Desenvolvimento no Ceará

Empresas com dimensionamentos já anunciados

Empresa	País	Potência (GW)	Investimento previsto US$ (bilhões)
Fortescue	Austrália	2,00	6,00
Qair	França	2,24	6,95
Casa dos Ventos/Comerc	Brasil	2,40	7,00
Energix	Australia	3,40	5,40
AES Brasil	Estados Unidos	1,00	2,00
Transhydrogen	Países Baixos	3,00	2,00
ENGIE	França	0,10	0,30
EDP	Portugal	1,25 MW	0,05
Total		**14,1**	**29,70**

US$ 29,7 bilhões de investimentos anunciados e 30 MoUs assinados

	Empresa	País
Até 2022	Hytron	Alemanha
	Linde/W. Martins	Alemanha
	Cactus Energia	Brasil
	Alupar	Brasil
	Diferencial	Brasil
	Eneva	Brasil
	H2 Green	Brasil
	H2 Helium	Brasil
	Nexway	Brasil
	Goldwind	China
	NEOENERGIA	Espanha
	HDF Energy	França
	Total Eren	França
	Enel Green Power	Itália
	Mitsui/Caetano Bus	Japão
	ABB Automation	Suiça
2023	Mingyang	China
	Powerchina	China
	Gansu Science and Technology	China
	Platform Zero	Holanda
	Green Hydrogen Corridor	Holanda
	Voltália	França

Algumas Estratégias Nacionais para o Hidrogênio

Japão

Creating a "Hydrogen Society" to Protect the Global Environment

The Strategic Road Map for Hydrogen and Fuel Cells ～Industry-academia-government action plan to realize "Hydrogen Society"～ (overall)

- In order to achieve goals set in the Basic Hydrogen Strategy,
- ① Set of new targets to achieve (Specs for basic technologies and cost breakdown goals), establish approach to achieving target
- ② Establish expert committee to evaluate and conduct follow-up for each field.

		Goals in the Basic Hydrogen Strategy		Set of targets to achieve	Approach to achieving target
Use	Mobility	FCV 200k by 2025 800k by 2030	2025	• **Price difference between FCV and HV** (¥3m → ¥0.7m) • **Cost of main FCV system** (FC ¥20k/kW → ¥5k/kW; Hydrogen Storage ¥0.7m → ¥0.3m)	• Regulatory reform and developing technology
		HRS 320 by 2025 900 by 2030	2025	• **Construction and operating costs** (Construction cost ¥350m → ¥200m; Operating cost ¥34m→¥15m) • **Costs of components for HRS** (Compressor ¥90m → ¥50m; Accumulator¥50m → ¥10m)	• Consideration for creating nation wide network of HRS • Extending hours of operation
		Bus 1,200 by 2030	Early 2020s	• Vehicle cost of FC bus (¥105m → ¥52.5m) ※In addition, promote development of guidelines and technology development for expansion of hydrogen use in the field of FC trucks, ships and trains.	• Increasing HRS for FC bus
	Power	Commercialize by 2030	2020	• Efficiency of hydrogen power generation (26%→27%) ※1MW scale	• Developing of high efficiency combustor etc.
	FC	Early realization of grid parity	2025	• Realization of grid parity in commercial and industrial use	• Developing FC cell/stack technology
Supply	Fossil Fuel +CCS	Hydrogen Cost ¥30/Nm3 by 2030 ¥20/Nm3 in future	Early 2020s	• Production: Production cost from brown coal gasification (¥several hundred/Nm3→ ¥12/Nm3) • Storage/Transport : Scale-up of Liquefied hydrogen tank (thousands m³→50,000m³) Higher efficiency of Liquefaction (13.6kWh/kg→6kWh/kg)	• Scaling-up and improving efficiency of brown coal gasifier • Scaling-up and improving thermal insulation properties
	Green H2	System cost of water electrolysis ¥50,000/kW in future	2030	• Cost of electrolyzer (¥200,000m/kW→¥50,000/kW) • Efficiency of water electrolysis (5kWh/Nm3→4.3kWh/Nm3)	• Designated regions for public deployment demonstration tests utilizing the outcomes of the demonstration test in Namie, Fukushima • Development of electrolyzer with higher efficiency and durability

https://www.env.go.jp/seisaku/list/ondanka_saisei/lowcarbon-h2-sc/PDF/Summary_of_Japan's_Hydrogen_Strategy.pdf

https://www.japan.go.jp/tomodachi/2017/spring-summer2017/creating_a_hydrogen_society.html

Chile

https://energia.gob.cl/h2/Estrategia-nacional-de-hidrogeno-verde

https://energia.gob.cl/documentos/hidrogeno-verde-un-proyecto-pais

Algumas Estratégias Nacionais para o Hidrogênio

Uruguai

H2U
Green Hydrogen
Roadmap in Uruguay

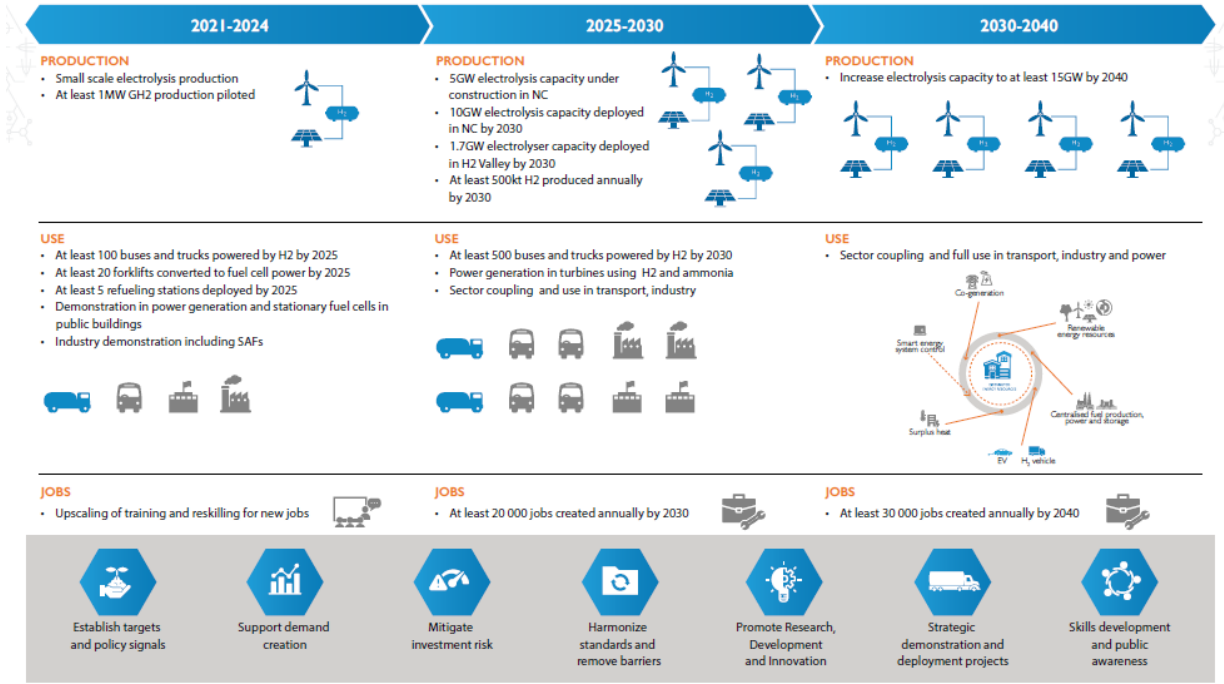
Roadmap phases	Phase 1 (2022 - 2025): Develop regulation; develop first pilot projects; attract first export-scale projects.	Phase 2 (2026 - 2030): Domestic expansion; start of the first export-scale projects.	Phase 3 (+2030): Large-scale domestic market; accelerated growth of exports.
Project overview	+1-2 small-scale projects implemented, larger-scale projects under development.	+3-4 medium-scale projects (100-200 MW) and +1-2 scaled projects.	+ medium-scale projects (100-200 MW) and + larger-scale projects.
Production (energy and hydrogen production)	• 200-500 MW of RES power capacity under development. • ~50 MW of H_2 production capacity for small scale and 100-300 MW under development.	• 2-4 GW of RES feed-in capacity. • 1-2 GW of H_2 production capacity.	• ~20 GW of RES capacity. • ~10 GW of H_2 and derivatives production capacity.
Demand (end uses in mobility, industry, and energy)	• +1-2 small-scale projects implemented for transportation uses (heavy trucks, long-distance buses, agricultural vehicles). • +1 project under development in synfuels (incl. methanol).	• ~1-2 scaled projects under development for synfuels. • +domestic transport projects; H_2 derivatives projects for maritime transport or fertilizers.	• ~3-4 scaled projects under development for synfuel, H_2 and NH_3 exports. More domestic projects throughout sectors (e.g., transportation, shipping, fertilizers, etc.).
Infrastructure and logistics (pipelines, storage, ports)	• Plan and develop detailed engineering for pipelines, transmission lines and ports. • Develop port solution for synfuels export in Montevideo.	• Plan and develop detailed engineering for Atlantic export ports. • Implement infrastructure plan (i.e., pipelines and transmission lines) and orchestrate coordinated deployment to capture synergies.	• Build logistics solution for export by coastal zone in the East. • Continue orchestrated coordination of infrastructure deployment to capture synergies.
Key mechanisms required: 1 Regulation. 2 Incentives. 3 Bilateral agreements. 4 Social license. 5 Talent.	1 Develop safety and technical standards and expedited permit processes. 2 Design incentive structure for Phase 2, provide financial and coordination support for pilots. 3 Establish bilateral agreements to promote the deployment of pilots and R&D development. 4 Launch hydrogen roadmap with clear signal to the transportation and synfuels sector. 4 Create national awareness and branding around the potential of the green hydrogen and derivatives industry. 5 Coordinate and design talent development programs with the private sector and academia.	1 Land area for infrastructure deployment in Phase 3. 2 Establish incentives focused on investment attraction, cost competitiveness and stimulation of domestic demand. 2 Ensure coordination along the value chain and support for project development at scale. 4 Create national awareness and branding around the potential of the green hydrogen and derivatives industry. 5 Implement talent development programs with the private sector and academia.	2 Consider additional incentives for specific domestic applications (e.g., synfuels blending quota) and to attract foreign investment.

https://www.gub.uy/ministerio-industria-energia-mineria/comunicacion/noticias/green-hydrogen-roadmap-in-uruguay

Africa do Sul

HYDROGEN SOCIETY
ROADMAP FOR SOUTH AFRICA 2021

DEPARTMENT OF SCIENCE AND INNOVATION



https://www.dst.gov.za/images/South_African_Hydrogen_Society_RoadmapV1.pdf

Brasil – Programa Nacional do Hidrogênio – PNH2

Eixos Temáticos do PNH2

Figura 3 - Eixos temáticos que compõem o PNH2

Fonte: https://www.gov.br/mme/pt-br/programa-nacional-do-hidrogenio-1

Contribuições para a Consulta Pública 147/2022 do MME

Em uma avaliação geral, a metodologia está bem concebida com seis eixos temáticos

O prazo de três anos para se chegar aos resultados objetivos, não atenderia à velocidade com que o mercado se desenvolve.

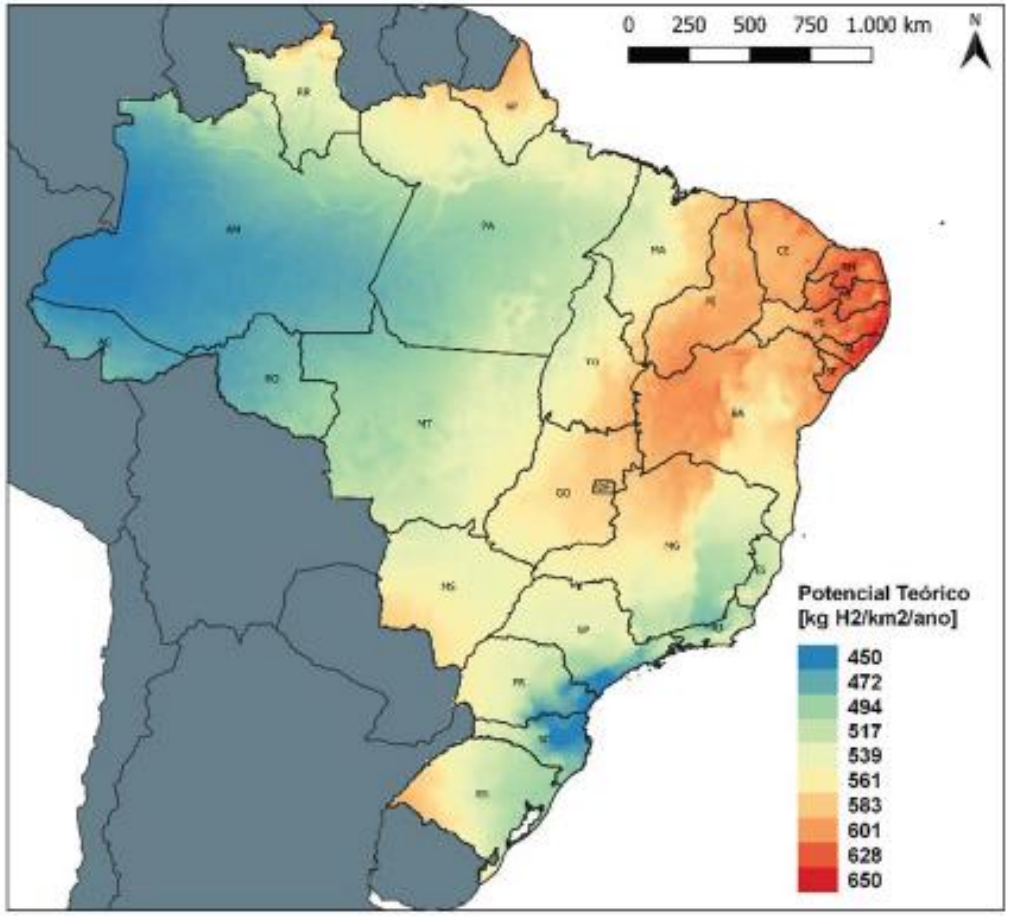
Precisa-se de um plano estratégico com visão de futuro clara, conclusiva e com etapas definidas.

Diretrizes, metas e ações específicas, com prazos, devem ser estabelecidas, para o atendimento à estratégia/visão geral.

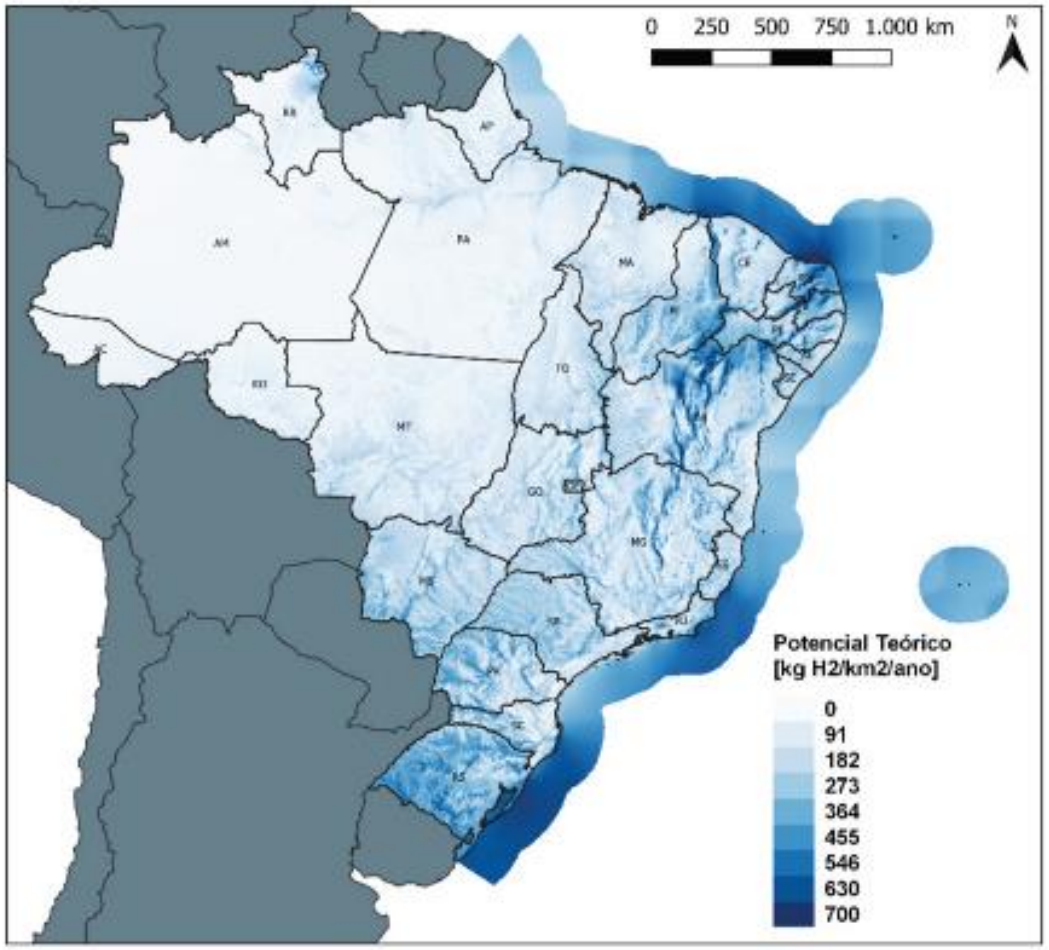
Fonte: Câmara Setorial de Energias da ADECE/SDE

Brasil – Potenciais para Produção de Hidrogênio

Potencial para produção de Hidrogênio com Energia Solar



Potencial para produção de Hidrogênio com Energia Eólica onshore e offshore



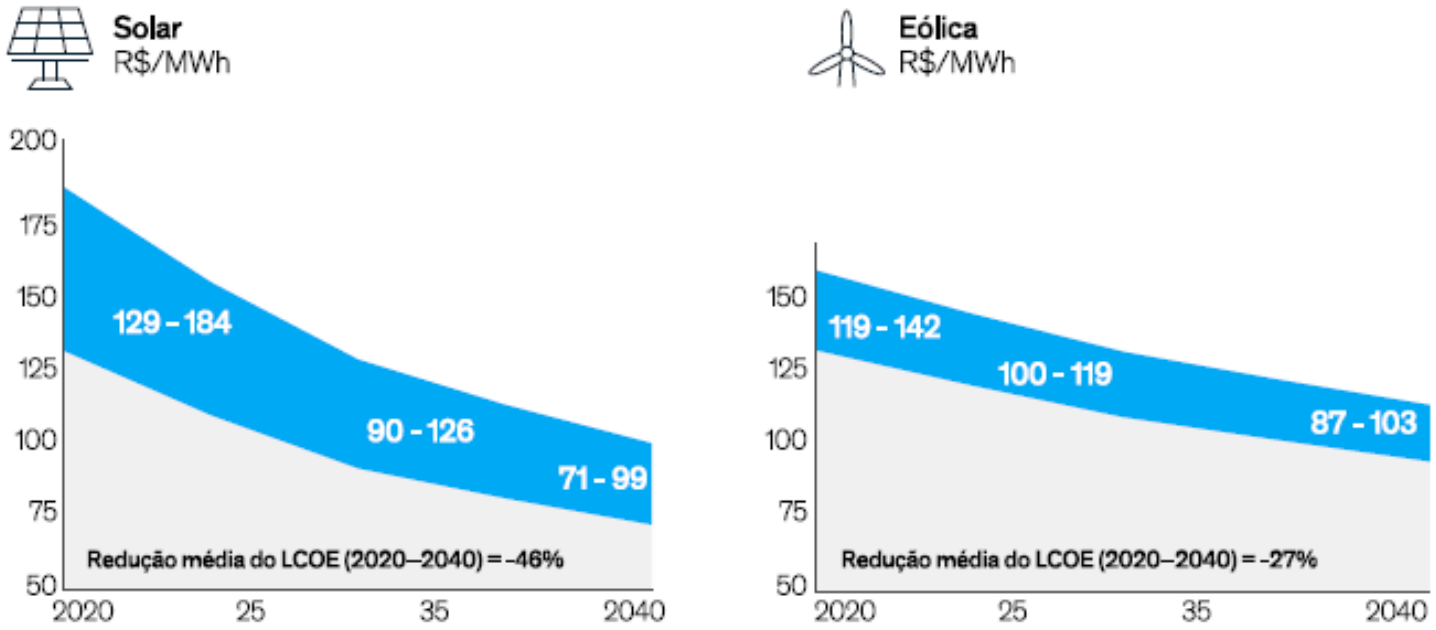
Fonte: Livro **Economia do Hidrogênio** https://bit.ly/3IeVRUU

Desafio para o H2V – Custo da Energia

O custo da energia solar e da eólica deve diminuir 46% e 27%, respectivamente

Projeção LCOE[1,2]

R$/MWh



[1] LCOE com base no estudo de Hidrogênio da McKinsey
[2] LCOE considera o fator de capacidade média fornecido pelo governo brasileiro e não inclui tarifa de transmissão (TUSTg)
Fonte: Estudo de hidrogênio verde da McKinsey

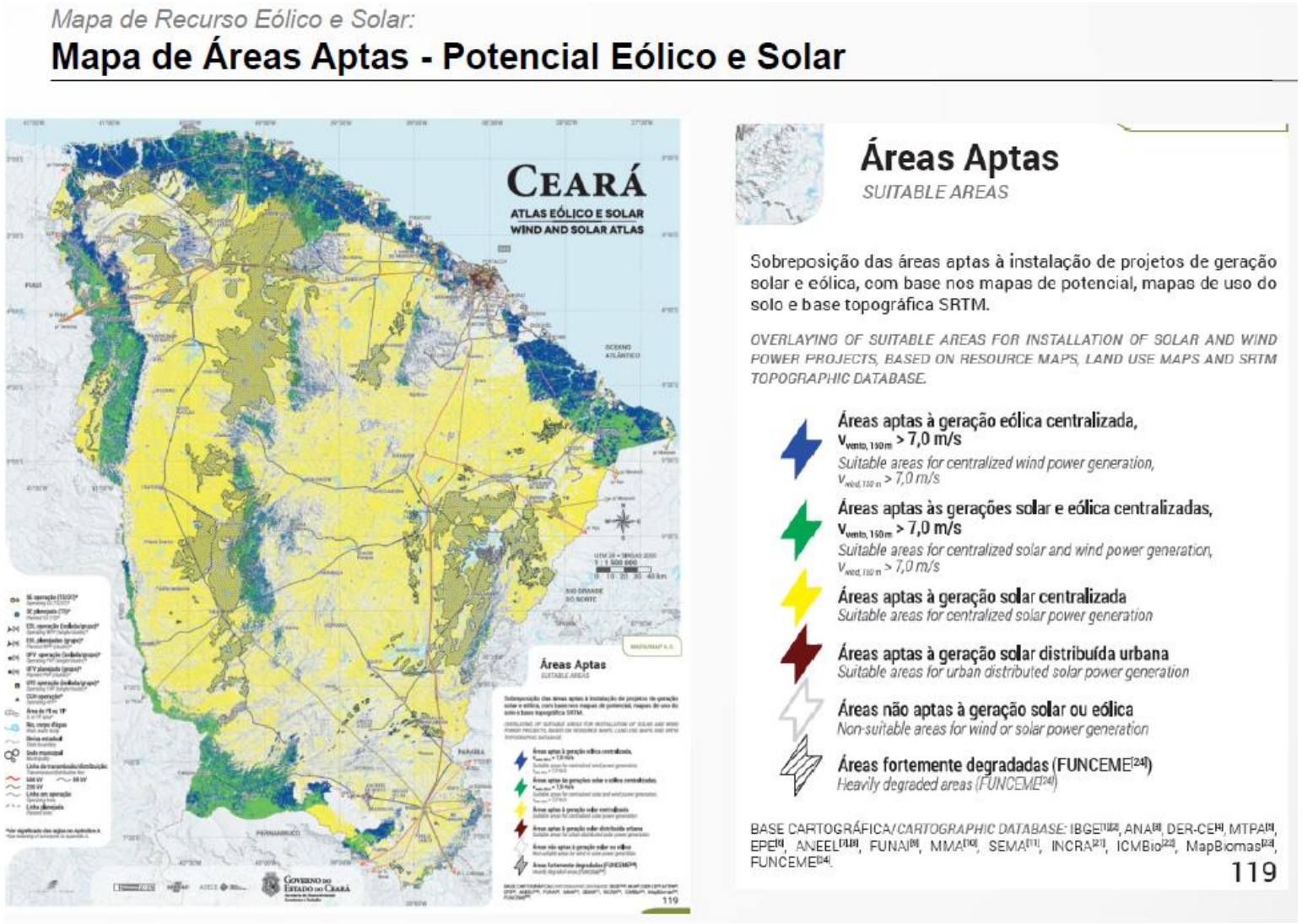
McKinsey & Company

Para a viabilização do hidrogênio verde, os custos com energia eólica e solar no Brasil precisam atingir valores da ordem de R$ 100/MWh até 2025

* atualmente de R$ 119 a 184/MWh)

1) Monitorar e propiciar condições para se confirmar as previsões
2) Propiciar custos adequados para a Tarifa dos Sistemas de Transmissão

Oportunidade com Geração Híbrida de Energia

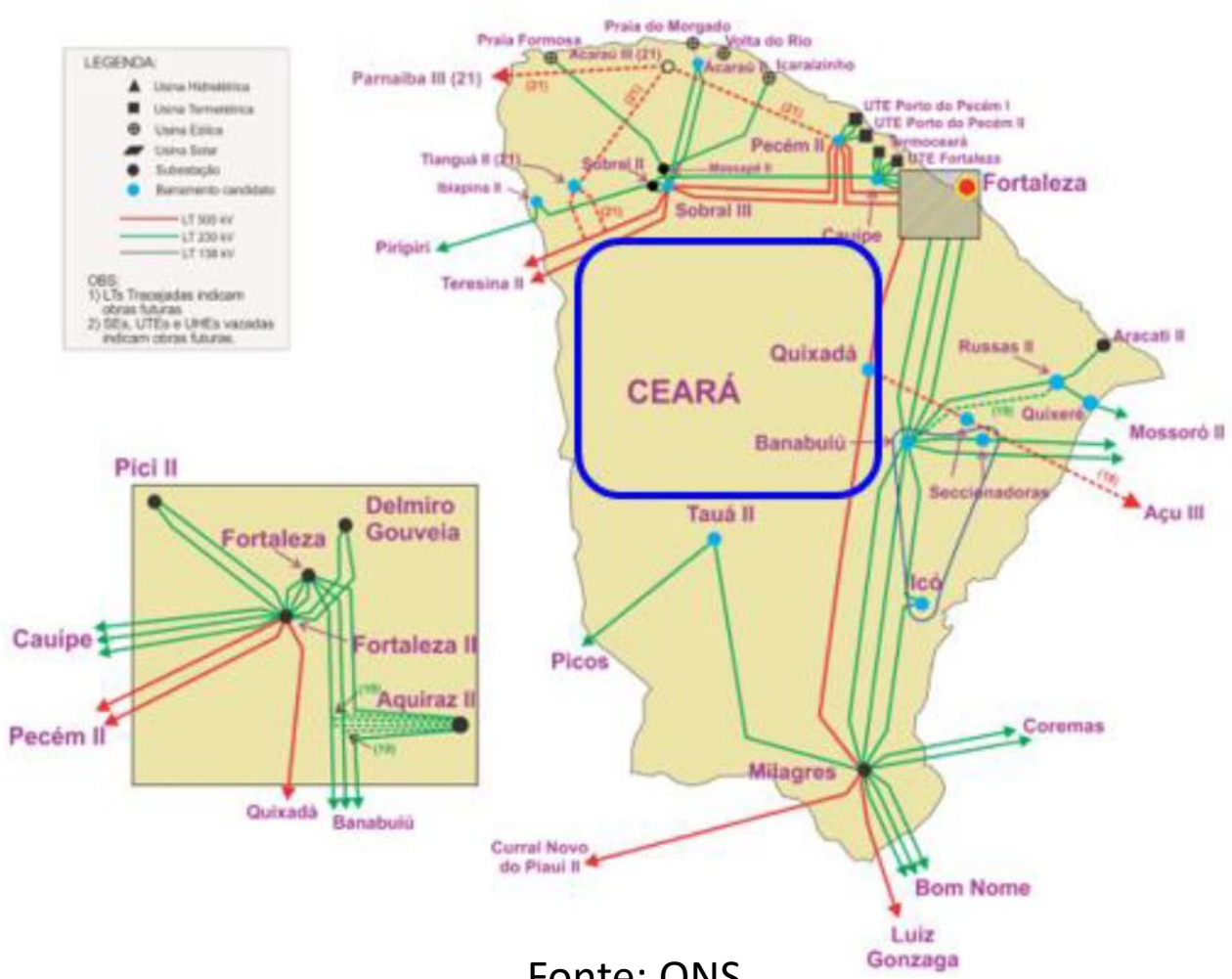


Utilizar áreas em processo de degradação ambiental para gerar energia, emprego e renda

http://atlas.adece.ce.gov.br/

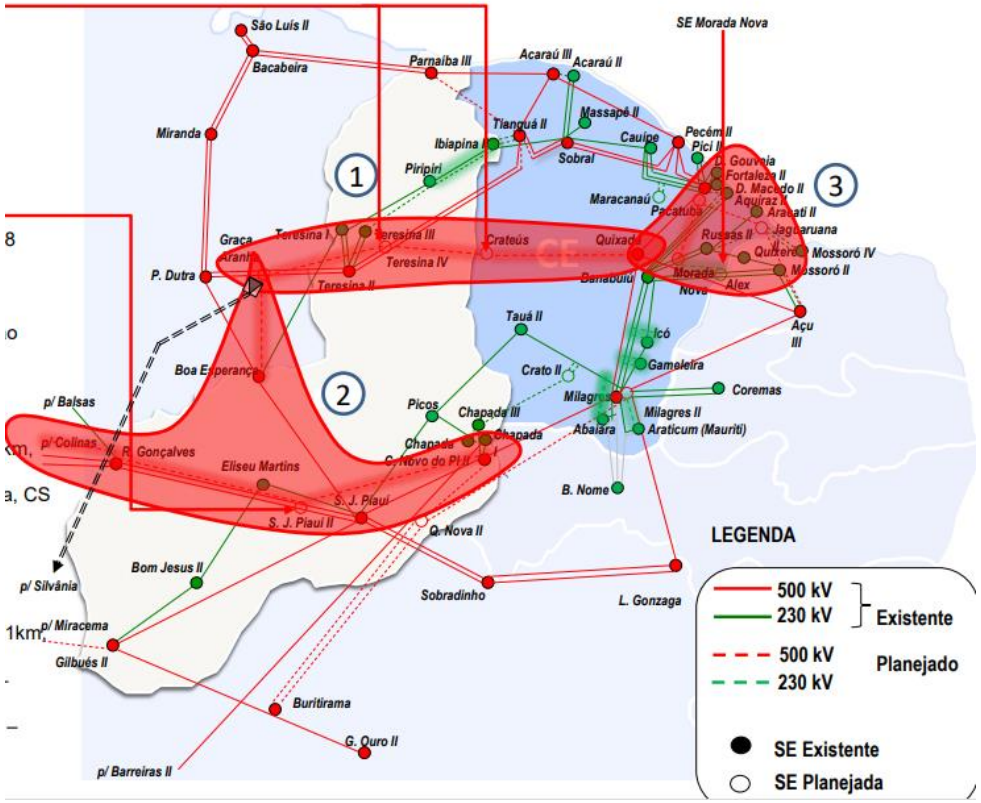
Desafio – Ampliar Transmissão de Energia

Vazio de Linhas de Transmissão no Sertão Central do Ceará



Fonte: ONS

Linha de Transmissão Quixadá/Crateús/Teresina)



1) Agilizar Leilão para LT;
2) Realizar Estudo Específico para o H2V

Obrigado !!

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