

Is Renewable Energy Sustainable? Potential relationships between renewable energy production and the Sustainable Development Goals

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The use of renewables is critical for achieving net zero carbon emissions



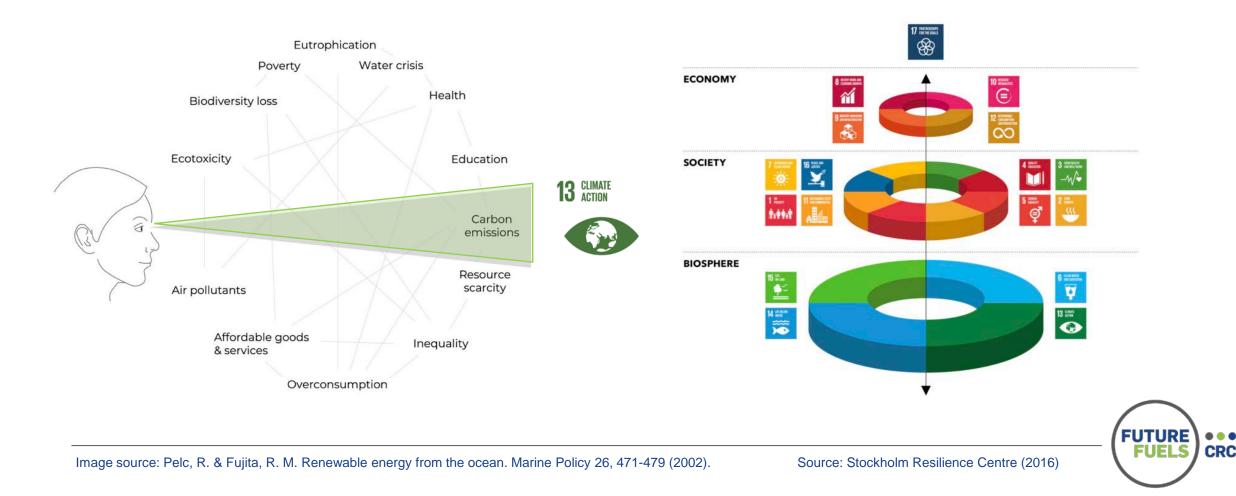
400MW Solar Power Plant, Bhadla

- Clean Energy Generation: Utilizes solar power to feed the national grid.
- Annual Production: Estimated at 732,874 MWh.
- Environmental Impact: Reduces ~694,471 tCO2e emissions annually.

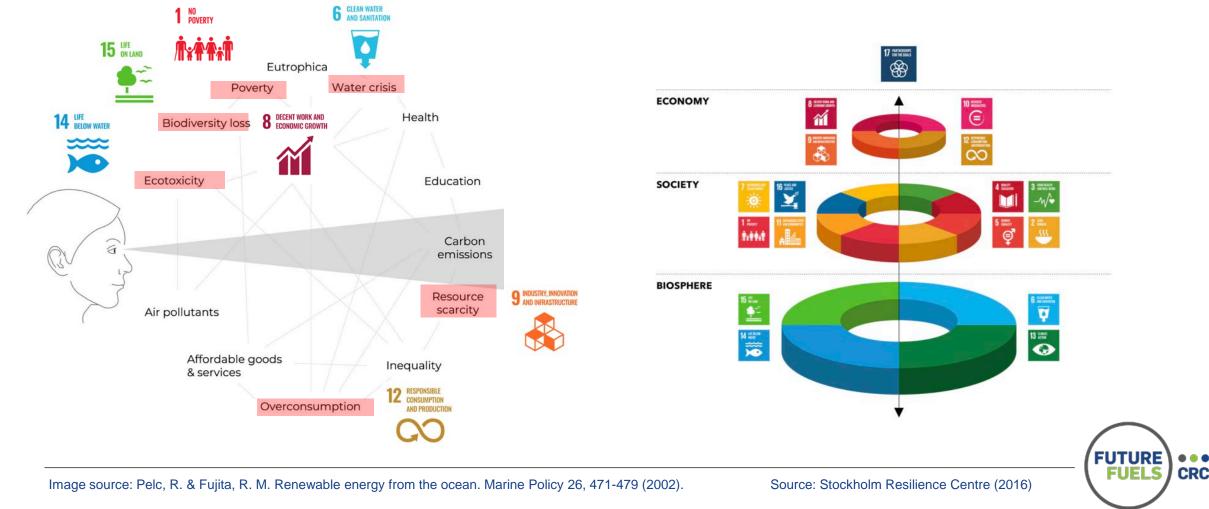
Image source: Google Earth



By focusing on net zero, we are at risk of ignoring broader sustainability outcomes



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By focusing on net zero, we are at risk of ignoring broader sustainability outcomes

Net zero 🗧 Sustainability

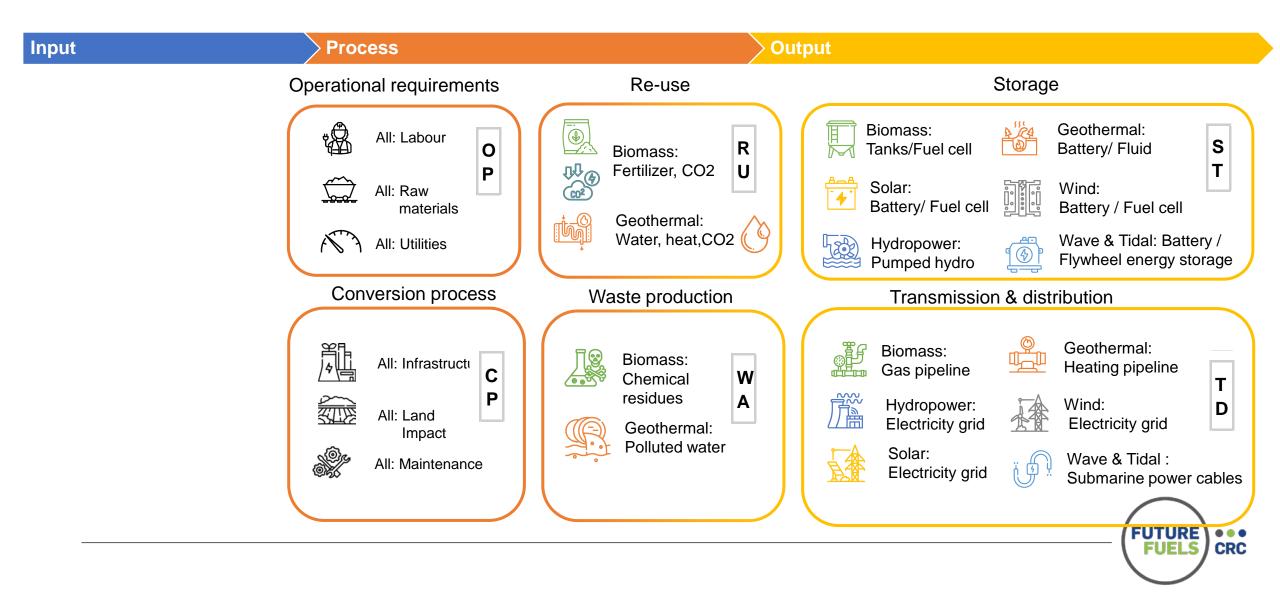


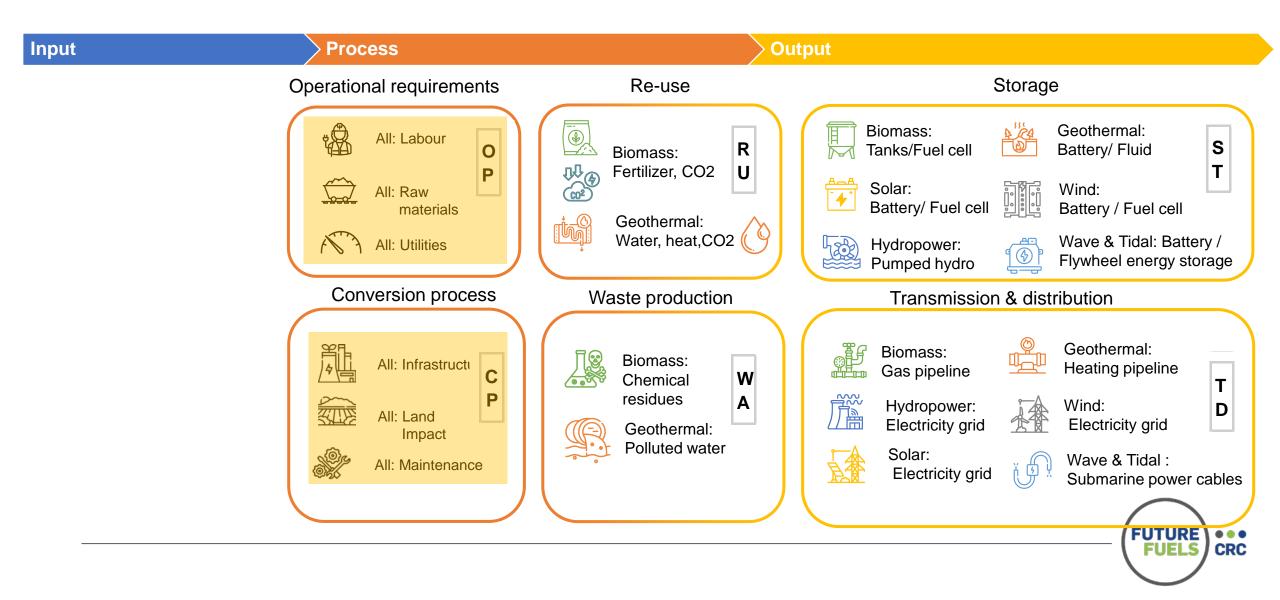
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Input	Process	Outpu	ıt				
					Storage	9	
				Biomass: Tanks/Fuel cell		•	S
				Solar: Battery/ Fuel cell		Wind: Battery / Fuel cell	<u> </u>
				Hydropower: Pumped hydro		Wave & Tidal: Battery A	
				Transmissior	n & dist	ribution	
				Biomass: Gas pipeline		Geothermal: Heating pipeline	т
				Hydropower: Electricity grid			D
				Solar: Electricity grid	, Đ	Wave & Tidal : Submarine power cat	bles
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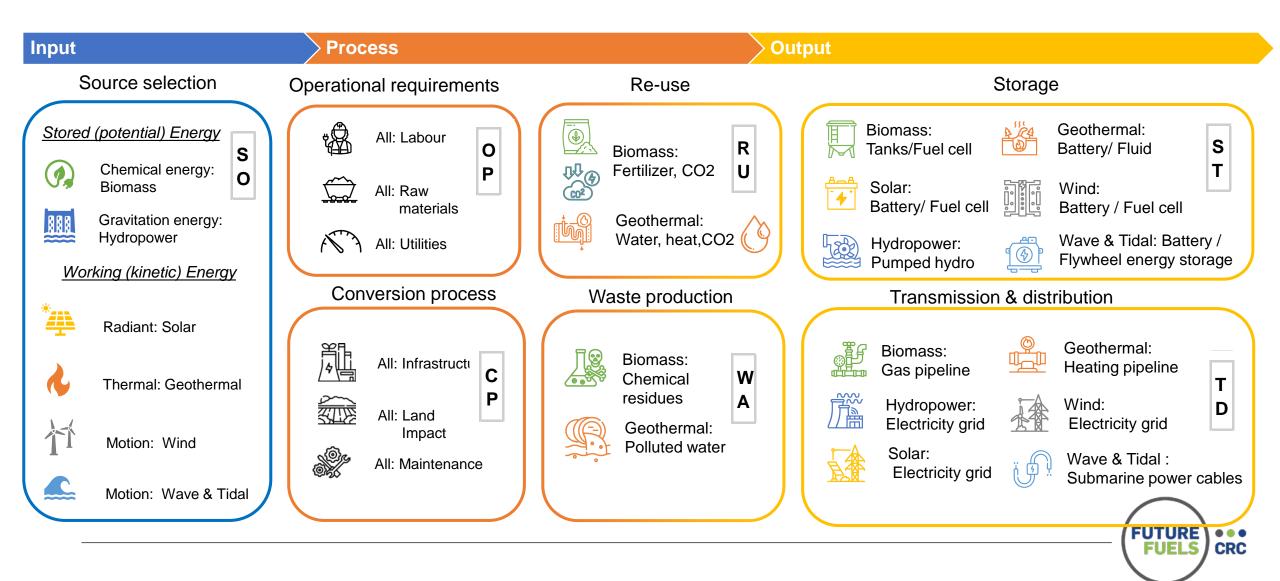
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Input	Process	Output
		Storage
		Biomass: Geothermal: Tanks/Fuel cell Battery/ Fluid S
		Solar: Battery/ Fuel cell Wind: Battery/ Fuel cell
		Hydropower: Pumped hydro
		Transmission & distribution
		Biomass: Gas pipeline Geothermal: Gas pipeline Heating pipeline
		Hydropower: Electricity grid Electricity grid
		Solar: Electricity grid Wave & Tidal : Submarine power cables

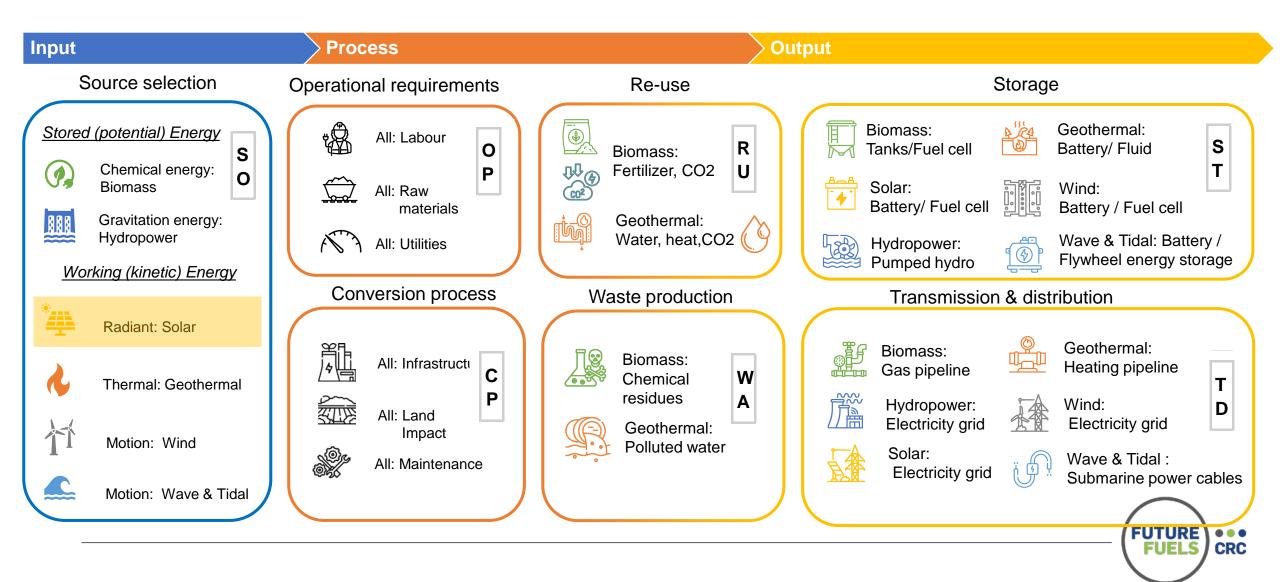


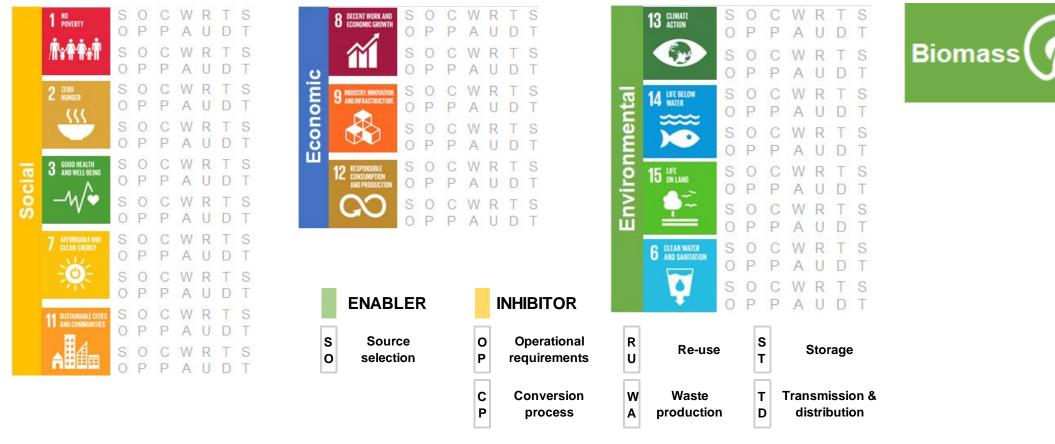


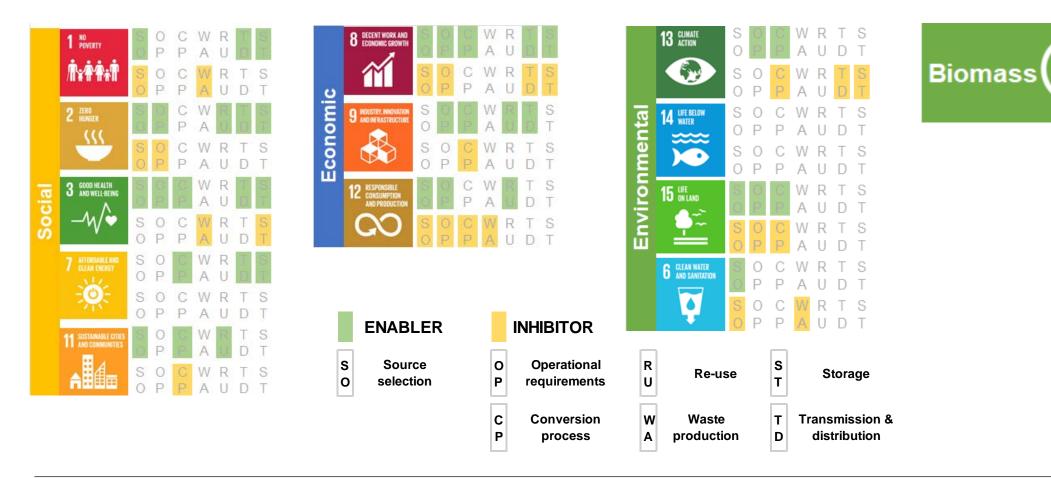
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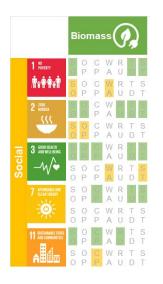
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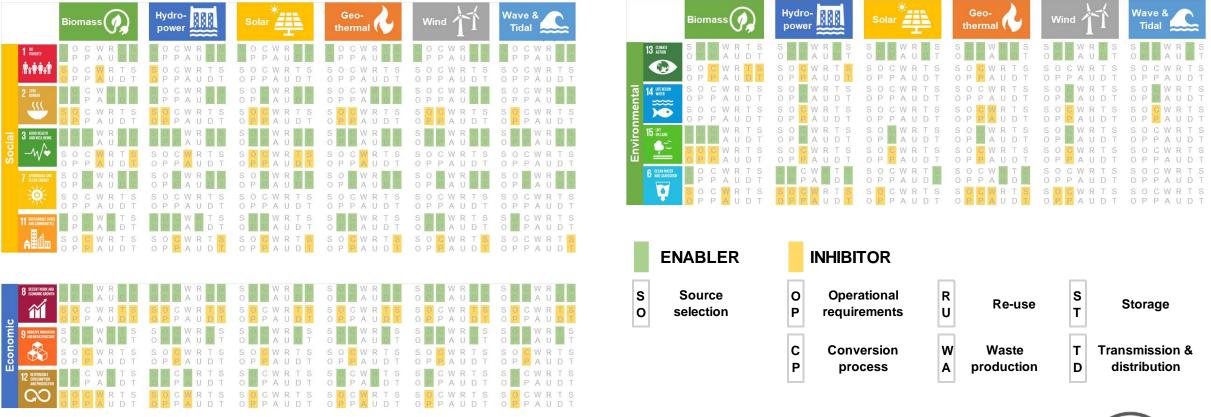




Biomass		
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nal R S Re-use Storage nts U **Transmission &** т n W Waste distribution Α production D







Biomass	Hydro- power	Solar	Geo- thermal	Wind	Wave &
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2 zad solar SOCWRTS	O C W R T S	S O O W R S O P A U D S O C W R T S	S O C W R F S O P P A G F F S O C W R T S	S O C W R S O P P A U S S O C W R T S	S O C W R O P P A U O S O C W R T S
	O P P A U D T	OPPAUDT SEWRES OCWRTS	OPPAUDT SCOWRTS OPPAUDT SOCWRTS	OPPAUDT SWRWR OPPAUDT SOCWRTS	OPPAUDT SOVAUDT SOCWRTS
7 MINUMERANT DAMINING OPAU	O P P A U D T S O B W R S O P A U D S O C W R T S	OPPAUDT SOPPAUDT SOCWRTS SOCWRTS	O P P A U D T S O G W R B S O P B A U D T S O C W R T S		
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	S O C W R T S O P P A U D T	SUBUWR OPPAUD SOCWRTS OPPAUDT	S O O W R S O P P A U P T S O C W R T S O P P A U D T	S O C W R T S O P P A U D T	S O C W R T S O P P A U D S O C W R T S O P P A U D T

Biomass () 13 CHART 13 CHART S O C W R T S O P P A U D T S O C W R T S O P P A U D T S O C W R T S O P P A U D T S O C W R T S O P P A U D T S O C W R T S O P P A U D T S O C W R T S O P P A U D T S O C W R T S O P P A U D T S O C W R T S O P P A U D T S O C W R T S O P P A U D T	Hydro- power S S S W R S S S S S W R S S S S S W R T S S S S W W R T S	Solar Solar Socwrss Socraft So	Geo- thermal C S O O W A S S O O W R T S O P P A U D T S O C W R T S O P P A U D T S O C W R T S O P P A U D T S O C W R T S	Wind WR S S W R S S O C W R T S O P A U D T S O C W R T S O P A U D T S O C W R T S O P A U D T S O C W R T S O P A U D T S O C W R T S	0 0 0 0 0 1 1 3 0 0 C W R T S 0 P P A U D T 5 0 P A U D T 5 0 P A U D T 5 0 P A U D T 5 0 C W R T S 6 P P A U D T
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	Biomass	Hydro- power	Solar	Geo- thermal	Wind	Wave &
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2 ZERO MUNGER				S O C W P D S O P P A D D S O C W R T S O P P A U D T	S O C W R S O P P A U U S O C W R T S O P P A U D T	S O C W R S O P P A U S S O C W R T S O P A U D T
		S O C W R T S O P P A U D T		S O C W R T S O P P A U D T		S O C W R T S O P P A U D T
7 OLIAN DAEROY		S O C W R T S O P A U D T	S O C W R S O P A U D S O C W R T S O P P A U D T			
	O C W R T S O C W R T S O P A U D T	S O C W R T S O P P A U D T	S C C W R T S O C W R T S S O C W R T S O P P A U D T	S C C W R T S O P P A U D T S O C W R T S O P P A U D T	S C C W R T S O C W R T S O C W R T S O P P A U D T	S C W R T S O P A U D T S O C W R T S O P P A U D T
8 DECENT WORK A					S C C W R T S	S C C W R S
	S O C W R T S O P P A U D T	SOCWRTS OPPAUDT SOVRSS	SOCWRTS OPPAUDT SOVRTS	S O C W R T S O P P A U D T S O W R S	S O C W R T S O P P A U D T S O W R S	S O C W R T S O P P A U D T S O W R S O A U D T
BIOLOGICAL STATES	S O <mark>C</mark> W R T S O P <mark>P</mark> A U D T	S O C W R T S O P P A U D T	S 0 C W R T S 0 P P A U D T S C W R T S	S O C W R T S O P P A U D T S C W T S	S 0 C W R T S 0 P P A U D T S C W R T S	S O C W R T S O P P A U D T S C W R T S
	Image: P A D T S O C W R T S O P P A U D T	SOCWRTS OPPAUDT	0 2 P A U D T S <mark>0</mark> C W R T S 0 P P A U D T	0 P A D T S 0 C W R T S 0 P P A U D T	0 P A U D T S 0 C W R T S 0 P P A U D T	0 P A U D T S 0 C W R T S 0 P P A U D T

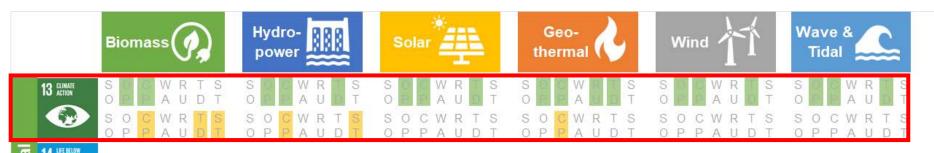
Biomass	Hydro-	olar	Geo- thermal	Wind	Wave &
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S Source O selection	O Operation P requirement		Re-use	S T	Storage
	C Conversi P proces		Waste production		nsmission & listribution

	Biomass	Hydro- power	Solar	Geo- thermal	Wind	Wave &
13 CLIMATE	S O O W R T S O D A U D T S O C W R T S O P P A U D T	S O O W R S S O O O O W R T S O O V R T S O P P A U D T	S C C W R T S O C W R T S O C W R T S O P P A U D T	SOCWRTS OPPAUDT	S O O O W R T S O O O O O T S O C W R T S O P P A U D T	S C C W R T S O C W R T S O C W R T S O P P A U D T
Imental	S O C W R T S O P P A U D T S O C W R T S O P P A U D T	SOOWRTS OPOAUDT SOCWRTS OPPAUDT	S O C W R T S O P P A U D T S O C W R T S O P P A U D T	S O C W R T S O P P A U D T S O C W R T S O P P A U D T	S O O W R T S O P A U D T S O C W R T S O P P A U D T	SOBWRTS OPBAUDT SOCWRTS OPPAUDT
Environmenta	SOCWRTSSOCWRTSOPAUDT	S O O W R T S O P A U D T S O C W R T S O P P A U D T	SOPPAUDT SOPPAUDT SOPPAUDT	S O O W R T S O P O A U D T S O C W R T S O P P A U D T	S O P A U D T S O C W R T S O P A U D T	S O C W R T S O P P A U D T S O C W R T S O P P A U D T
6 CLEAN WATER AND SANITATION	0 C W R T S P P A U D T S O C W R T S O P P A U D T	C W P T P A U D S O C W R T S O P P A U D T	S O C W R T S O P P A U D T S O C W R T S O P P A U D T	S O C W B T S O P P A J D T S O C W R T S O P P A U D T	S O C W R T S O P P A U D T S O C W R T S O P P A U D T	S O C W R T S O P P A U D T S O C W R T S O P P A U D T



Underestimation of negative sustainability impacts

6 CLEAN WATER AND SANITATIO

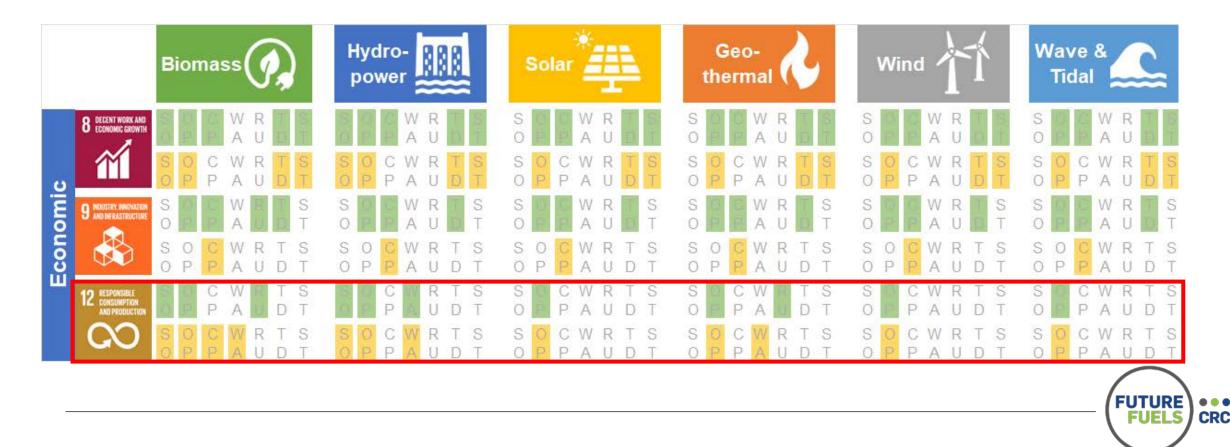


- Biomass: The emission leakage through the transmission line.
- Hydropower: The release of deep underwater emissions.
- Geothermal: the release of greenhouse gases when drilling.

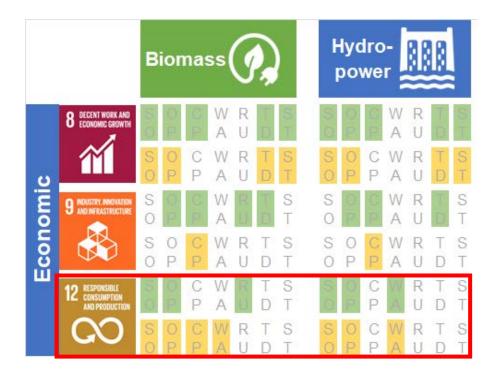


	Biomass	Hydro- power	Solar	Geo- thermal	Wind T	Wave &
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2 ZERO HOINGER		O P P A U D T O C W R T S P P A U D	OPPAUDT SOCWRES OPEAUDE	O P P A U D T S O C W R S O P P A U D S	O P P A U D T S O C W R T O P P A U D	O P P A U D T S O C W R O P P A U U
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9 ACCTIFY NORMAL AND INFERSION		S O O W R S S O O O A U O T S O C W R T S O P P A U D T	S O C W R T S O D A U D T S O C W R T S O P P A U D T	S C C W R C S O C C W R T S O C W R T S O P P A U D T	S C C W R S S C C W R T S O P P A U D T	S O O W R S O O O O O O O O O O O O O O O O O O O
12 ESSPONSIBLE CONSUMPTION AND PRODUCTI			S C W R T S O P A U D T S C W R T S			
ŝ	OPPAUDT	OPPAUDT	OPPAUDT	OPPAUDT	OPPAUDT	OPPAU

Biomass	Hydro- power	Solar	Geo- thermal	Wind	Wave &
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S Source O selection			R Re-use	s T	Storage
			W Waste A production		nsmission & listribution



Underestimation of negative sustainability impacts



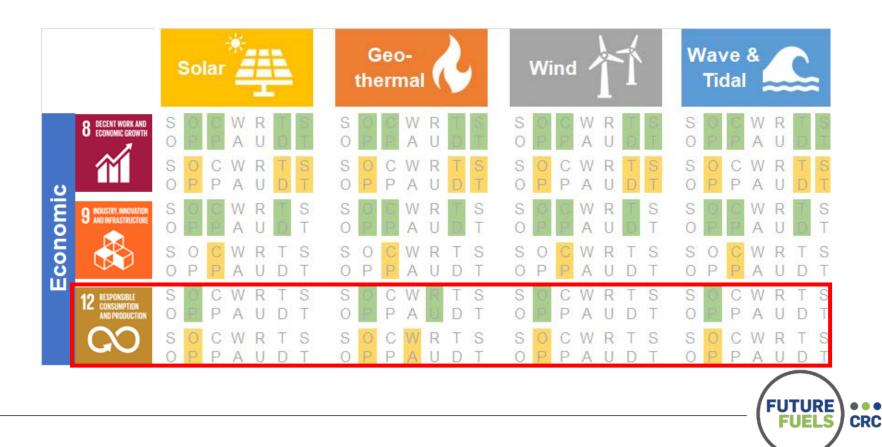
For Biomass and Hydropower: There is a big impact on SDG 12.

This is because these energy types require transmission, storage, and pre-processing of raw materials before energy is generated.



Underestimation of negative sustainability impacts

For Solar, Geothermal, Wind and Wave/tidal, there is minimal impact on SDG 12.



Underestimation of positive sustainability impacts



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	Biomass	Hydro- power	Solar	Geo- thermal	Wind TT	Wave &
	13 climate S S S W R T S A U D T S O C W R T S	S C W R S S O C M A U S T S O C W R T S	S C C W R S S O C W R T S	S O O W R S S O A A O T S O C W R T S	S W R S O A U T S O C W R T S	S C W R S S O C A U D T S O C W R T S
TATA THE SHARE			O P P A U D T S O C W R T S O P P A U D T S O C W R T S	O P P A U D T S O C W R T S O P P A U D T S O C W R T S	O P P A U D T S O W R T S O P A U D T S O O W R T S	O P P A U D T S O W R T S O P A U D T S O O W R T S
		O P P A U D T S O W R T S O P A U D T	O P P A U D T S O W R T S O P A U D T	O P P A U D T S O D W R T S O P P A U D T	O P P A U D T S O G W R T S O P A U D T S O G W R T S	O P <mark>P</mark> A U D T S O C W R T S O P P A U D T
	6 C W R T S	O P P A U D T C W T T P A D D	O P P A U D T S O C W R T S O P P A U D T	O P P A U D T S O C W R T S O P P A U D T	O P P A U D T S O C W R T S O P P A U D T	O P P A U D T S O C W R T S O P P A U D T
Biomass	olar Geo- thermal	Wind	Wave &	S O C W R T S O P P A U D T	S O C W R T S O P P A U D T	S O C W R T S O P P A U D T
	O C W R T S O C W R T S P P A U D T D P A U D T	O C W R T P P P A U	O C W R T P P A U	For agi	riculture	use:
INTERPRETENDE SOCWRTS SOCWRTS SOCURTS	OCWRTS SOCWRTS PPAUDT OPPAUDT	S O C W R T S O P P A U D T	S O C W R T S O P P A U D T	Shadin	g from so	olar
	O W R S O C W R S P A U D C O P P A U D T	S O C W R B S O P P A U U U	S O C W R I S O P P A U U I		can imp	
OPPAUDT OPPAUDT O	OCWRTS SOCWRTS PPAUDT OPPAUDT	S O C W R T S O P P A U D T	S O C W R T S O P P A U D T			
3 Monthered a U A U A U A U A U A U A U A U A U A U		S B B A U B F		produc	ction.	
S W SOCWRTS SOCWRTS SI OPPAUDT OPPAUDT O	OCWRTS SOCWRTS PPAUDT OPPAUDT	S O C W R T S O P P A U D T	S O C W R T S O P P A U D T			

			Biomass	Hydro- power	Solar	Geo- thermal	Wind	Wave &
		13 climate	S C C W R T S O P P A U D T S O C W R T S O P P A U D T	S C W R S O A U D T S O C W R T S O P P A U D T	S C W R T S O P P A U D T S O C W R T S O P P A U D T	S O O W P T S O P P A O T S O C W R T S O P P A U D T	S B B W R S O B A U D T S O C W R T S	S C W R S O A U S T S O C W R T S
		mental	S O C W R T S O P P A U D T S O C W R T S O P P A U D T	S O W R T S O P A U D T S O W R T S O P A U D T	S O C W R T S O P P A U D T S O C W R T S O P P A U D T	S O C W R T S O P P A U D T S O C W R T S O P P A U D T		S O O W R T S O P A U D T S O C W R T S
		Environ	S O C W R T S O P A U D T	S O C W R T S O P C A U D T S O C W R T S O P P A U D T	S O W R T S O P D A U D T S O C W R T S O P P A U D T	S O C W R T S O P P A U D T S O C W R T S O P P A U D T	S O W R T S O P A U D T S O C W R T S O P A U D T	S O C W R T S O P P A U D T S O C W R T S O P P A U D T
Biomass	Hydro- 888		OCWRTS PPAUDT Geo-	Wind	SOCWRT OPPAUD Wave &	S O C W B T S O P P A U D T S O C W R T S O P P A U D T	S O C W R T S O P P A U D T S <mark>O C</mark> W R T S O P P A U D T	S
	Hydro- power		thermal (V)		Tidal	For ter	ritorial u	se:
	S O C W R T S P P A U D T O C W R T S P P A U D T	S O C W R T S O P P A U D T S O W R T S O P A U D T	S O C W R T S O P P A U D T S O C W R S O P P A U D T	S O C W R T S O P P A U D T S O C W R T S O P P A U D T	S O C W R T S O P P A U D T S O C W R S O P P A U D		bose the	
	S O C W R T S O P P A U D T	S O C W R T S O P P A U D T S O W R T S	S O C W R T S O P P A U D T S O O W R T S	S O C W R T S O P P A U D T S O W R S	S O C W R T S O P P A U D T S O W R	degrad	led land.	FUTUR
	S O C W R T S O P P A U D T	SOCWRTS OPPAUDT	S O C W R T S O P P A U D T	S O C W R T S O P P A U D T	S O C W R T S O P P A U D T			

The full range of potential sustainability impacts needs to be considered when developing renewables

Net zero × Sustainability



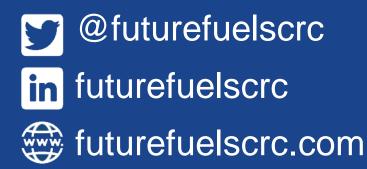


Thank you for your attention

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Enabling the decarbonisation of Australia's energy networks



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AusIndustry Cooperative Research Centres Program

Methodology

Translating broad goals into specific targets/indicators and defined the direct and indirect connections.



By 2030, ensure universal access to affordable, reliable and modern energy services

Indicators -

7.1.1

Proportion of population with access to electricity

7.1.2

Proportion of population with primary reliance on clean fuels and technology

- Indirect effect: a connection to SDG 7 or 13, but not any other SDGs.
- No connections: The existing literature does not show contributions to the targets/indicators.
- Note that SDGs 4, 5, and 10 are excluded from this study since no direct relationships with quantitative indicators could be identified in literature.

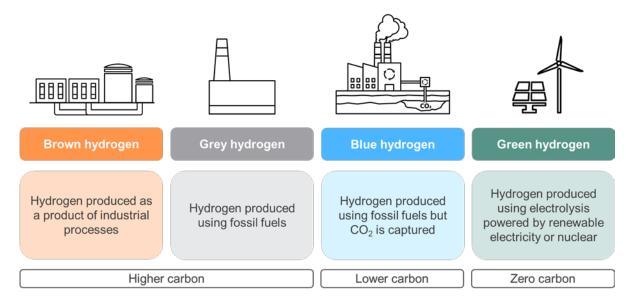


Apply to all energy types

	Biomass	Hydro- power	Solar	Geo- thermal	Wind T	Wave &
1 №инт Л¥†† ÷Й	OCWRTS PPAULT SOCWRTS OPPAUDT	O C W R C C W R C C W R C C W R C C W R C C W R C C W R C C W R C C W R C C W R C C W R C W R C W R C W R C W R C W R C W R C W R C W R C W R C W R C W R C W R C W R C W R C W R C W R C W R	O C W R D D P P A U D S O C W R T S O P P A U D T	S O C W R C S P P A U C T S O C W R T S O P P A U D T	0 C W R P P A U S 0 C W R T S 0 P P A U D T	O C W R D P P A U D T S O C W R T S O P P A U D T
2 ZERO MUMBER	C W R T S P A D T S O C W R T S O P A U D T	OCWRTSPPAUCTSOCWRTSOPPAUDT	S O W R S S O P A U D S O C W R T S O P P A U D T	S O C W R T S O P P A D T S O C W R T S O P P A U D T	S O C W R T S O P P A U D T S O C W R T S O P P A U D T	S O C W R S O P P A U D S S O C W R T S O P P A U D T
	S O C W R T S O P P A U D T	S O C W R T S O P P A U D T	S C W R T S O C W R T S O P P A U D T	S O C W R T S O P P A U D T S O C W R T S O P P A U D T	S O C W R T S O P P A U D T	S D D D A U D T S O C W R T S O P P A U D T
7 OLAN INERCY	S O C W R T S O P O A U O T S O C W R T S O P P A U D T	S O C W R T S O P C A U C C S O C W R T S O P P A U D T	S O C W R T S O P P A U D T S O C W R T S O P P A U D T	S O O W R T S O P F A U D T S O C W R T S O P P A U D T	S O C W R T S O P A U D T S O C W R T S O P P A U D T	S O C W R T S O P R A U O T S O C W R T S O P P A U D T
	SOCWRTS SOCWRTS OPPAUDT	S O C W R T S S O C W R T S O P P A U D T	S C C W R T S O C W R T S S O C W R T S O P P A U D T	S C C W R T S O P P A U D T S O C W R T S O P P A U D T	S D D W R T S O D D A U D T S O C W R T S O P P A U D T	S O C W R T S O P A U D T S O C W R T S O P P A U D T
8 BECENT WOR	KANG S D S W R S S P P A U D T	S O O W R T S	S D D W R D S O P P A U D T	SOOWRTS OPPAUDT	S D D W R T S O P B A U D	SOOWROS OPPAUD
Economic		SOCWRTS OPPAUDT SOMWRS OMAUDT		SOCWRTS OPPAUDT SOBWRS OPAUDT	SOWRS	
12 ESPONSE INDERCOL	OPPAUDI	SOCWRTS OPPAUDT SCRTS PUDT	O P <mark>P</mark> A U D T	S O C W R T S O P P A U D T S O C W T S O P P A U D T	OP <mark>P</mark> AUDT S S CWRTS	FOP <mark>P</mark> AUDT SS <mark>M</mark> CWRTS
CC CC	SOCWRTS OPPAUDT	S O C W R T S O P P A U D T	S O C W R T S O P P A U D T	S O C W R T S O P P A U D T		

Why not include hydrogen?

Hydrogen is an energy carrier, and renewable energy sources are used in its generation process..





Preliminary links to the SDGs

The 400 MW Solar power project of Bhadla, Rajasthan' project aligns with the following UN Sustainable Development Goals:



- Replacing 732,874 MWh/year amount of electricity with renewable energy.
- Reduces emissions of greenhouse gases estimated to be approximately 694,471 tCO2e per year



• No. of employment opportunities created: 10



Data source: https://marketplace.goldstandard.org/products/eki-energy-services-gold-standard-foundation-400-mw-solar-power-project-at-bhadla-rajasthan-india