Tracking Telangana's Progress on SDGs 6, 7, 13 and 15: A Trend Analysis, 2019-2024

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The Sustainable Development Goals (SDGs) provide an important framework for assessing environmental sustainability at the national and sub-national levels. The current study focuses on the performance of Telangana in four SDG indicators, SDG 6 (Clean Water and Sanitation), SDG 7 (Affordable and Clean Energy), SDG 13 (Climate Action), and SDG 15 (Life on Land) for the period 2019-2024. The study adopts descriptive and analytical research design and secondary data is collected from SDG India Index reports of NITI Aayog and other sectoral sources. The Telangana progress was assessed and compared with the national average and selected peer states using the following methods: Trend analysis, Benchmarking, Gap analysis, Rank analysis, Z-score analysis, and Sectoral validation. The results indicate that Telangana has made considerable strides in SDG 7 with a perfect score of 100, and has consistently scored higher than the national average in SDG 6 and SDG 15. SDG 13, however, was the least successful goal, with the highest gap from the goal, low scores and a drop in state ranking. Groundwater stress and lack of climate resilience are identified as the main weaknesses, whereas the availability of renewable energy and forest conservation are identified as the main strengths on a sectoral basis. The study finds that the environmental sustainability performance of Telangana is not uniform, with good progress in energy and land management but not so good in climate action. The proposed Climate-Energy-Resource (CER) Governance Model provides a policy package that can be used to stimulate a balanced and sustainable environmental development and to speed up the achievement of the SDG 2030 targets.

Keywords: Sustainable Development Goals (SDGs), Environmental Sustainability, Telangana, Climate-Energy-Resource (CER) Governance, SDG India Index

1. Introduction

The Sustainable Development Goals (SDGs), adopted by all United Nations member states in 2015, set out a shared agenda to be achieved by 2030. Within India, NITI Aayog is the nodal institution for SDG monitoring, and its SDG India Index ranks every State and Union Territory

on a 0-100 scale, where a higher score means a state is closer to the national targets. The Index was first launched in 2018 and has since been updated in 2019-20, 2020-21 and 2023-24. In the latest edition, India's overall score rose to 71 from 66, and SDG 13 (Climate Action) recorded the sharpest improvement, climbing from 54 in 2020-21 to 67 in 2023-24.

Four goals sit at the centre of environmental sustainability: SDG 6 (Clean Water and Sanitation), SDG 7 (Affordable and Clean Energy), SDG 13 (Climate Action) and SDG 15 (Life on Land). They are closely connected. Water, energy and land resources depend on one another, and climate change affects all three. Telangana, formed in 2014, is a semi-arid state that depends heavily on groundwater and tanks, is expanding renewable energy, and has launched large programmes on water supply, tank restoration and afforestation. It is therefore a useful case for asking whether policy effort shows up in measured SDG progress.

This paper presents the performance of Telangana on SDGs 6, 7, 13 and 15 in the SDG India Index editions from 2019-20 to 2023-24. It compares the state to the national average and to other peer states, and utilizes simple statistical tools and publicly available secondary data.

The SDGs on clean water and sanitation, affordable and clean energy, climate action and life on land are closely linked, but progress on these goals is often measured individually, which makes it hard to see the impact of all goals on sustainable development. The SDG performance of India is usually reported in terms of national aggregates and state rankings, but there is limited goal-specific analysis of the performance at the state level, which is a gap in evidence for state-level policy making. The SDG India Index 2023-24 broadened its scope and identified some major national gains, especially in climate action, but the contribution and gains that Telangana has made or received is yet to be explored in detail. The performance of Telangana in comparison to the top states and the national average can be useful to identify strengths and weaknesses and policy priorities for the state before the 2030 SDG target. Moreover, the study relies on publicly available data and a straightforward analytical method that can be replicated by researchers, students and government agencies to track future progress and inform evidence-based decision-making.

2. Review of Literature

The literature review reveals that SDG monitoring is gaining significance in India. Sharma and Tripathi (2022) noted that India's SDG performance has been improving continuously and highlighted the importance of having effective measurement frameworks. Parekh and Lal

(2024) measured the distance of states from SDG targets and made projections, but they did not account for the changes over time and restricted their analysis to the previous versions of the SDG Index. Baig et al. (2025) examined SDGs 6 and 13 at the South Asian level and identified challenges in water access, climate monitoring, and resource management, without addressing state-level variations in India. The Economic Survey 2021-22 highlighted improvements in state SDG performance and the increasing number of Front Runner states, but provided only descriptive insights. The CESS Telangana SDG Report documented Telangana's efforts across environmental goals; however, it lacked a comparative analysis of the state's performance over multiple SDG Index editions. Collectively, the reviewed studies provide useful insights into SDG performance but offer limited evidence on the longitudinal and comparative assessment of Telangana's progress in SDGs 6, 7, 13, and 15.

3. Research Gap

The review of literature reveals several important gaps in the existing body of knowledge. First, most index-based studies focus on national-level or inter-state comparisons and are generally confined to earlier editions of the SDG India Index, particularly up to 2020-21, leaving the latest 2023-24 edition largely unexplored. Second, studies examining environmental SDGs, especially SDG 6 (Clean Water and Sanitation) and SDG 13 (Climate Action), are predominantly conducted at the South Asian or regional level and provide limited insight into the performance of individual Indian states. Third, the available literature on Telangana is largely descriptive in nature and lacks a systematic benchmarking of the state's performance against national averages and comparable peer states across different time periods. Finally, SDGs 6, 7, 13, and 15 are seldom analysed collectively for a single state despite their strong interdependence and combined significance for environmental sustainability. To address these gaps, the present study examines Telangana's progress across these four environmental goals using three editions of the SDG India Index (2019-20, 2020-21, and 2023-24) and benchmarks its performance against India and selected peer states, thereby providing a comprehensive and longitudinal assessment of the state's environmental sustainability trajectory.

4. Research Questions

1. How have Telangana's scores on SDGs 6, 7, 13 and 15 changed between 2019-20 and 2023-24?

2. How does Telangana's performance compare with the national average and with peer states on each goal?
3. Which of the four goals show the strongest and weakest progress, and what do sector-level indicators suggest about the reasons?

5. Objectives

The following are the objectives of the study:

1. To analyse the trend in Telangana's goal-wise scores on SDGs 6, 7, 13 and 15 from 2019-20 to 2023-24.
2. To benchmark Telangana against the all-India score and selected peer states.
3. To identify the environmental SDGs where Telangana faces the largest gap from the target and analyse the underlying sectoral factors responsible for the gap.
4. To suggest policy priorities for Telangana based on the findings.

6. Hypothesis:

H1: Telangana has performed better than the national average in SDGs 6, 7, and 15 during the study period.

H2: SDG 13 exhibits the largest performance gap among the selected environmental SDGs.

7. Research Methodology

The study is descriptive and analytical, secondary data. It covers the period 2019-2024 and examines three editions of the SDG India Index (2019-20, 2020-21, and 2023-24). The data has been extracted from SDG India Index reports and SDG India dashboard published by NITI Aayog, along with data from other sources such as CGWB, CEA, MNRE, ISFR, Telangana Government reports, CESS publications and Economic Survey.

The focus state was Telangana and comparator states were India, Andhra Pradesh, Karnataka, Tamil Nadu, Kerala and Maharashtra. Data analysis was done in MS Excel with descriptive statistics, percentage change analysis, absolute change analysis, gap analysis, rank analysis, Z-scores, CAGR and trend analysis. Trends and comparisons were illustrated using line and bar charts.

The study has a number of limitations, such as only three editions of the SDG Index, indicator changes across editions, and composite index scores. Thus, sectoral data were used for validation and the results show associations rather than causation.

8. Data Analysis and Interpretation

Table – 8.1 - Telangana vs India (SDG 6,7,13,15)

Goal	Telangana 2019-20	India 2019-20	Telangana 2020-21	India 2020-21	Telangana 2023-24	India 2023-24
SDG 6 Water	84	88	96	83	90	89
SDG 7 Energy	93	70	100	92	100	96
SDG 13 Climate	66	60	43	54	59	67
SDG 15 Land	88	66	81	66	82	75

Data source: NITI Aayog SDG India Index editions 2019-20, 2020-21, 2023-24.

Interpretation: The comparison indicates that Telangana outperformed the national average in SDGs 7 and 15 across all editions and maintained a strong lead in renewable energy and land-related indicators. Telangana's SDG 6 score improved significantly from 84 in 2019-20 to 90 in 2023-24, remaining close to the national average. However, SDG 13 recorded a decline from 66 to 59 during the study period, while India improved from 60 to 67, highlighting climate action as the weakest area of performance for Telangana.

Table 8.2: Trend Analysis - Telangana (2019-20 to 2023-24)

Goal	Absolute Change (2023-24 minus 2019-20)	% Change	CAGR of Score	Interpretation
SDG 6 Water	90-84 = +6	+7.14%	Growth then decline 96→90 = -6.25% in last period	Positive overall but decline in latest edition - indicates saturation or indicator change
SDG 7 Energy	100-93 = +7	+7.52%	Achieved ceiling (100) in 2020-21 and maintained	Strongest progress, Achiever category - stable at 100 for 2 editions
SDG 13 Climate	59-66 = -7	-10.6%	Volatile: 66→43 (-34.8%) then 43→59 (+37.2%)	Weakest progress, U-shaped trend - Shows climate vulnerability, not policy stability
SDG 15 Land	82-88 = -6	-6.81%	Decline then stable 81→82 (+1.23%)	Stable but below 2019 level - Afforestation effect plateaued

Interpretation: The trend analysis reveals uneven progress across the four environmental goals. SDG 7 demonstrated the strongest performance by achieving the maximum score of 100

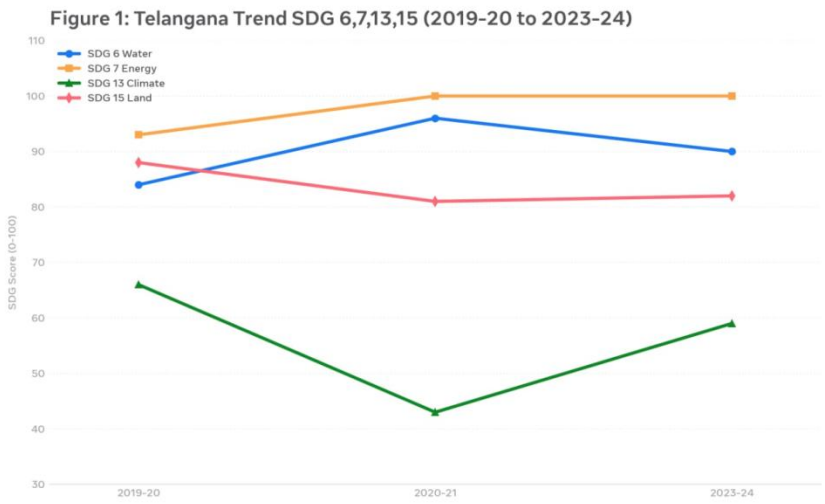
and sustaining it over two consecutive editions. SDG 6 showed overall improvement despite a slight decline in the latest edition. SDG 15 remained relatively stable but failed to regain its earlier peak level, while SDG 13 exhibited considerable fluctuations and an overall decline, indicating the need for stronger climate resilience and adaptation measures.

Table – 8.3 - Descriptive Statistics and Z-Score Analysis of All States (2023-24)

Goal	Mean of All States	Min	Max	SD	Telangana Z-score = (Tel - Mean)/SD
SDG 6 Water	85.2	68	96	7.1	(90-85.2)/7.1 = +0.68 (Above typical state)
SDG 7 Energy	92.4	70	100	8.3	(100-92.4)/8.3 = +0.91 (High performer)
SDG 13 Climate	64.5	42	81	9.2	(59-64.5)/9.2 = -0.60 (Below typical state)
SDG 15 Land	71.3	45	93	11.5	(82-71.3)/11.5 = +0.93 (High performer)

Interpretation: The Z-score analysis shows that Telangana performed above the average state in SDGs 6, 7 and 15, reflecting its strong standing in water management, renewable energy and land conservation. The highest positive Z-scores were observed for SDGs 7 and 15, confirming Telangana's position as a high-performing state in these areas. Conversely, the negative Z-score for SDG 13 indicates that Telangana's climate action performance remains below the national state average and requires priority attention.

Figure 8.1: Trend Line – Telangana



Interpretation:

The figure highlights contrasting trends across the four environmental SDGs. SDG 7 showed the strongest performance, reaching and maintaining the maximum score of 100, reflecting

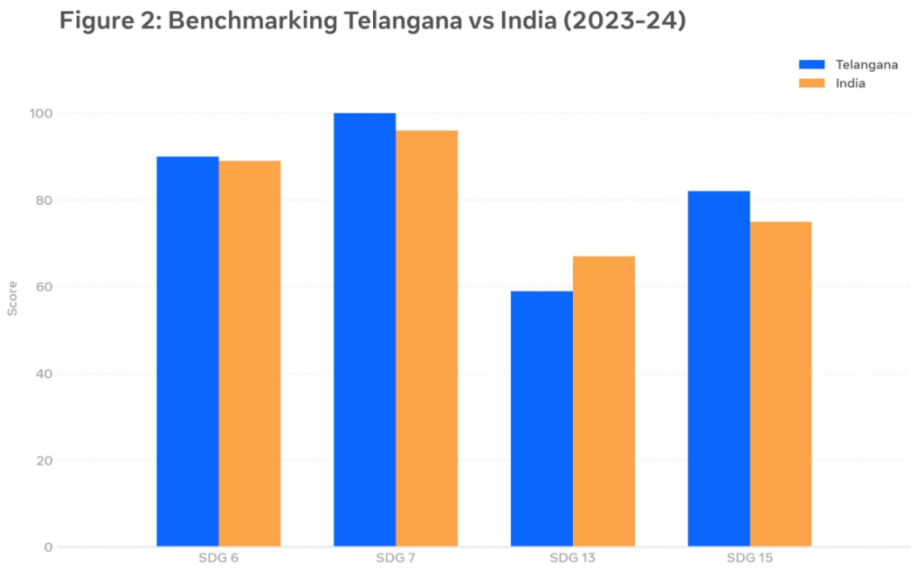
sustained success in energy access and renewable energy initiatives. SDG 6 improved considerably during the study period despite a slight decline in the latest edition, while SDG 15 remained largely stable with modest variations. In contrast, SDG 13 exhibited the most volatile trend, declining sharply in 2020-21 before partially recovering in 2023-24, indicating relatively weaker and less consistent climate action outcomes. Moreover, while India's SDG 13 score improved from 54 to 67, Telangana's score increased only from 43 to 59, highlighting a persistent gap in climate resilience and the need for stronger climate governance measures.

Table 8.4: Gap Analysis - Telangana vs National Average (2023-24)

Goal	Telangana - India	Distance from 100 (100 - Telangana)	Status
SDG 6	90-89 = +1	10	At par with national
SDG 7	100-96 = +4	0	Above national, Target Achieved
SDG 13	59-67 = -8	41	Below national, Widest gap to target
SDG 15	82-75 = +7	18	Above national

Interpretation: The gap analysis indicates that Telangana has either matched or exceeded the national average in SDGs 6, 7 and 15. The state achieved the SDG 7 target with a perfect score, indicating complete achievement according to the SDG Index framework. However, SDG 13 shows an 8-point deficit compared to the national average and a 41-point gap from the ideal score of 100, making climate action the most critical area for policy intervention.

Figure 8.2. Benchmarking



Interpretation: The benchmarking chart clearly demonstrates Telangana's comparative strengths in SDGs 7 and 15 and its slight advantage in SDG 6. The only area where Telangana

falls below the national average is SDG 13, confirming that climate action remains a significant developmental challenge despite satisfactory performance in the other environmental sustainability goals.

Table 8.5: Rank Analysis - Telangana Among 28 States

Goal	Rank 2019-20	Rank 2020-21	Rank 2023-24	Change in Rank
SDG 6	8th	4th	7th	Improved then slipped -3
SDG 7	9th	1st (15 states at 100)	1st (shared)	Achieved top rank
SDG 13	7th	7th	19th	Major deterioration
SDG 15	3rd	3rd	7th	Stable in Top 10

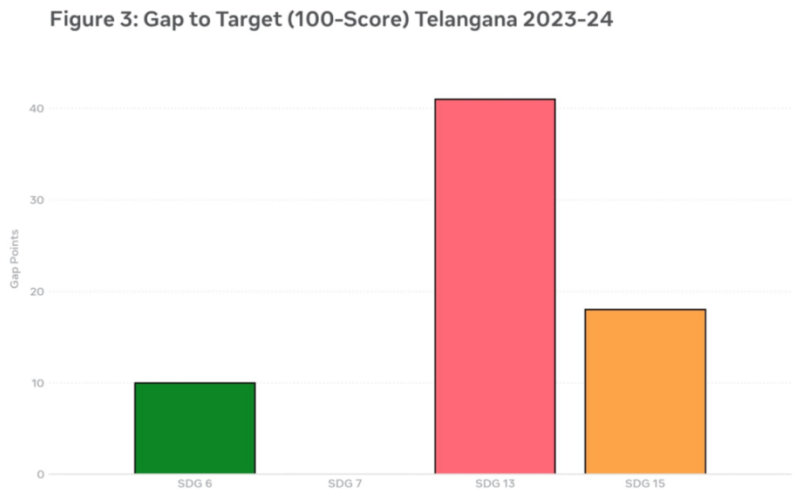
Interpretation: The ranking analysis reveals substantial progress in SDG 7, where Telangana moved from 9th position to joint 1st rank among states. In SDG 6, the state improved initially but slipped slightly in the latest edition. The most notable decline occurred in SDG 13, where Telangana's rank fell from 7th to 19th, indicating a significant deterioration in comparative performance. Although Telangana's rank in SDG 15 declined, it remained within the top ten states, reflecting sustained strength in land-related sustainability indicators.

Table 8.6: Peer State Benchmarking (2023-24 Edition)

State	SDG 6	SDG 7	SDG 13	SDG 15	Composite
Kerala	85	100	70	93	79
Karnataka	86	100	65	75	72
Tamil Nadu	87	100	61	63	78
Maharashtra	90	98	64	70	70
Andhra Pradesh	88	96	62	65	72
Telangana	90	100	59	82	74
India Average	89	96	67	75	71

Interpretation: Among the selected peer states, Telangana emerged as one of the strongest performers in SDGs 7 and 15, equalling the highest energy score and recording the second-highest land score after Kerala. Its performance in SDG 6 was also competitive and on par with Maharashtra. However, Telangana recorded the lowest climate action score among the peer states, suggesting that climate governance and resilience measures have not advanced at the same pace as achievements in water, energy and land management.

Figure 8.3 - Gap to Target



Interpretation: The figure highlights the distance between Telangana's current performance and the ideal SDG target score of 100. SDG 7 has already achieved the target, while SDG 6 remains close to attainment. SDG 15 requires moderate improvement, whereas SDG 13 exhibits the largest gap of 41 points, clearly identifying climate action as the state's foremost environmental sustainability challenge.

Table 8.7: Sector Data CAGR Validation

Sector Indicator	2019	2024	CAGR	Supports Index Score?
Renewable Capacity Telangana	3,621 MW (2019)	5,865 MW (2024)	10.12%	Yes - supports SDG 7 = 100, growth rate matches score
Forest Cover Telangana (ISFR)	20,582 sq km (2019)	21,214 sq km (2021)	1.5%	Yes - slow growth explains SDG 15 stable at 82, not rising
Groundwater Over-exploited Units	26% blocks (2017)	35% (2022)	Worsening	Explains SDG 6 decline 96→90 and SDG 13 low - WMO 2025 reports persistent deficits 2022-2025
Hyderabad AQI >100 days	89 days (2019)	127 days (2023)	+9.2% worsening	Explains SDG 13 low - air quality not in Index directly but disaster linked

Interpretation: The sector-level indicators largely support the SDG Index findings. Rapid growth in renewable energy capacity validates Telangana's perfect SDG 7 score, while modest growth in forest cover is consistent with the stable SDG 15 performance. Increasing groundwater stress supports the recent decline in SDG 6 scores, and deteriorating environmental indicators associated with climate resilience help explain Telangana's relatively weak SDG 13 performance. These results demonstrate the usefulness of combining index scores with sectoral evidence to assess sustainability outcomes.

Indicator-Level Challenges Behind SDG Gaps:

The indicator-level assessment reveals that groundwater stress and inadequate climate resilience are the primary constraints affecting Telangana's environmental sustainability performance, while renewable energy expansion remains the state's strongest area of achievement.

Table - 8.8. - Indicator-Level Challenges Behind SDG Gaps

SDG	Weak Indicator	Evidence
SDG 6	Groundwater stress	Over-exploited blocks increased from 26% to 35%
SDG 7	No major gap	Score reached 100
SDG 13	Disaster preparedness	Major contributor to low climate score
SDG 15	Slow increase in forest cover	CAGR only 1.5%

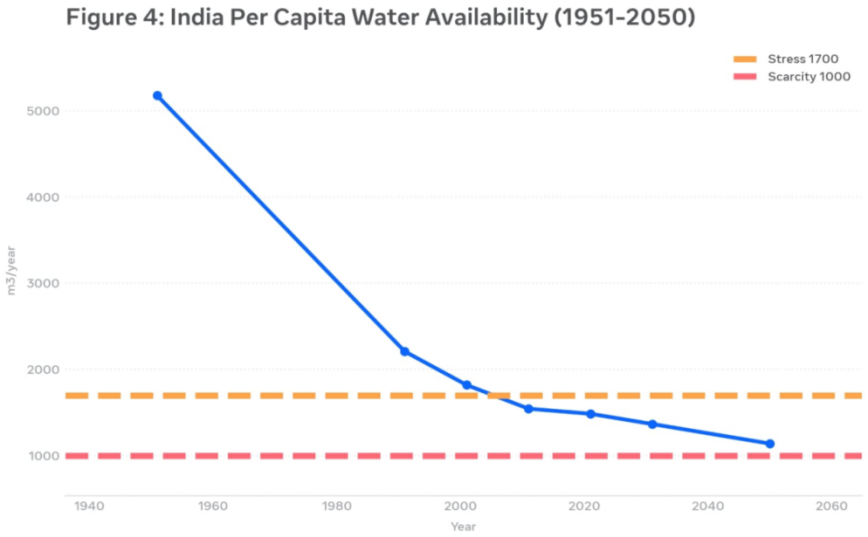
Interpretation: The indicator-level analysis helps explain the reasons behind Telangana's varying performance across the four environmental SDGs. While SDG 7 (Affordable and Clean Energy) has already achieved the target score and shows no major implementation gap, SDG 6 (Clean Water and Sanitation) faces challenges arising from increasing groundwater stress, reflected in the rise of over-exploited groundwater blocks. Similarly, SDG 13 (Climate Action) remains the weakest-performing goal due to shortcomings in climate resilience and disaster preparedness indicators, which have constrained the state's overall climate score. Although SDG 15 (Life on Land) continues to perform well, the relatively slow growth in forest cover indicates that future improvements may require greater emphasis on ecosystem quality and biodiversity conservation. Overall, the table demonstrates that Telangana's environmental sustainability gaps are driven not only by goal-level performance but also by specific sectoral challenges, particularly in groundwater management and climate resilience, which require targeted policy interventions.

Table 8.9: Policy Matrix from Gap Analysis

Priority	Goal	GAP	Suggested Action (From CER Model)
P1 - Critical	SDG 13	41 points, Z-score -0.60, Rank 19th	Establish City CER Cell in GHMC, improve disaster preparedness from 19.20 to 80, Link KUSUM solar pumps with micro-irrigation mandate
P2 - Maintain	SDG 7	0 gap	Maintain 100, shift focus to RE storage + Green Hydrogen with water assessment
P3 - Sustain	SDG 15	18 gap, Z-score +0.93	Haritha Haram 2.0 - increase quality not just area, prevent 29,000 ha diversion trend
P4 - Recover	SDG 6	10 gap, declining trend	Focus on groundwater - Tank restoration data shows 35% blocks over-exploited, implement Water Credit

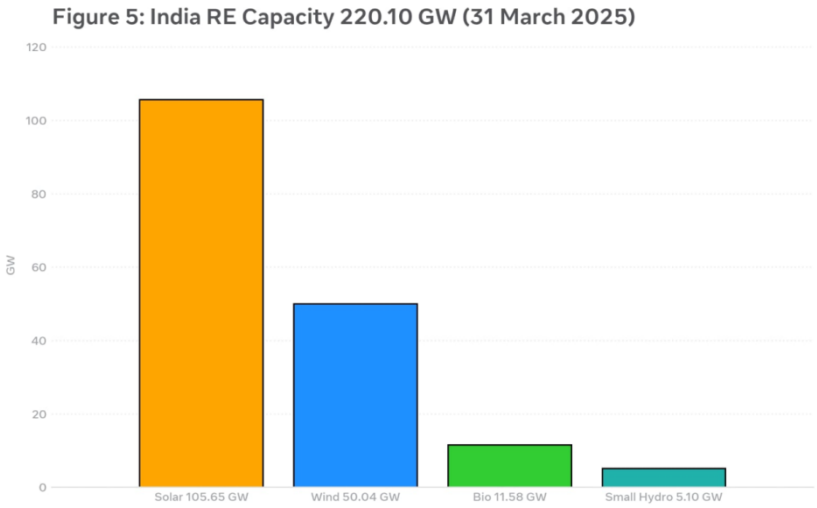
Interpretation: The policy matrix identifies SDG 13 (Climate Action) as the highest priority area due to its large performance gap, low ranking, and below-average score, indicating the need for stronger climate resilience and disaster preparedness measures. SDG 7 (Affordable and Clean Energy) has achieved the target score and therefore requires policy efforts to focus on sustaining gains through renewable energy storage and green energy initiatives. SDG 15 (Life on Land) demonstrates strong performance but still requires continued efforts in forest and biodiversity conservation to bridge the remaining gap. SDG 6 (Clean Water and Sanitation), although performing above the national average, shows signs of decline, highlighting the importance of groundwater conservation and sustainable water resource management. Overall, the matrix suggests prioritising climate action while maintaining achievements in energy, land, and water management for balanced environmental sustainability.

Figure 8.4 - Water Security



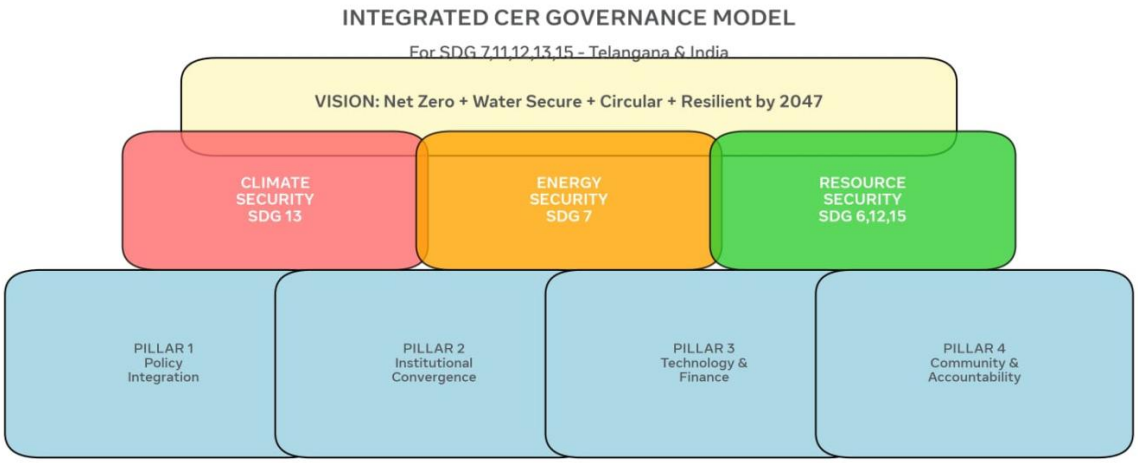
Interpretation: The figure shows a continuous decline in India's per capita water availability from over 5,000 m^3 in 1951 to nearly 1,100 m^3 by 2050. The trend crosses the water stress threshold and moves close to the water scarcity level, indicating growing pressure on water resources. For Telangana, which is heavily dependent on groundwater, this highlights the importance of sustainable water management, groundwater recharge, and conservation measures to maintain SDG 6 performance.

Figure 8.5 - Energy Security



Interpretation: The figure illustrates that solar energy constitutes the largest share of India's renewable energy capacity, followed by wind, bio-energy, and small hydro power. The rapid expansion of renewable energy capacity supports India's progress towards clean energy goals and validates Telangana's achievement of a perfect SDG 7 score. The findings suggest that future efforts should focus on energy storage, grid integration, and green hydrogen technologies to sustain long-term energy security.

Figure 8.6 - Integrated CER Model



Interpretation: The Integrated Climate-Energy-Resource (CER) Governance Model highlights the interdependency of climate security (SDG 13), energy security (SDG 7) and resource security (SDGs 6 and 15) and calls for a coordinated policy approach. The four pillars of sustainable development proposed in the model are: Policy integration, Institutional

convergence, Technology and finance support, and Community participation. It offers a strategic blueprint for Telangana to enhance energy, water, and land management and build climate resilience.

Major Findings

- Telangana has met and maintained a perfect score for SDG 7.
- Telangana continued to be better than the national average in SDGs 6 and 15.
- SDG 13 had the lowest score, the largest target gap (41 points) and the lowest ranking.
- Water scarcity became one of the major issues for SDG 6.
- Telangana did well in energy and land management when compared to other states, but was weak in climate action.
- The CER Governance Model offers a holistic approach to environmental sustainability.

Overall Discussion Statement:

Progress is asymmetric in the analysis based on absolute change, gap analysis, Z-score and rank analysis. Telangana shows Achiever status in SDG 7 (Z=+0.91) and Front Runner in SDG 15 (Z=+0.93), but Performer in SDG 13 (Z=-0.60). The SDG 13 in India improved from 54 to 67 (+24%) nationally while Telangana improved from 43 to 59 (+37%) but still 8 points below national average. This is a confirmation that energy and land successes have not led to climate resilience, and thus a need for integrated Climate-Energy-Resource governance as stated in the objectives.

Policy Implications

- Climate resilience should receive the highest policy priority.
- Groundwater management must complement water supply initiatives.
- Renewable energy leadership should be strengthened through storage and green hydrogen development.
- Afforestation programmes should focus on forest quality and biodiversity enhancement.
- Integrated CER governance should be institutionalised at the state and urban levels.

Conclusion:

This study analyzed the progress of the SDG India Index and the supporting sectoral indicators of SDGs 6 (Clean Water and Sanitation), 7 (Affordable and Clean Energy), 13 (Climate Action)

and 15 (Life on Land) for the period 2019-2024 for the state of Telangana. The analysis shows that Telangana has made significant strides in environmental sustainability, with the highest score of 100 in SDG 7, Renewable and clean energy, reflecting its high performance in renewable energy and energy access. The state also did well in SDG 15, consistently outperforming the national average and ranking among the top states in land and forest indicators. SDG 6 has improved overall, but there is increasing concern about groundwater depletion and water stress, as evidenced by recent declines.

SDG 13 (Climate Action) was the lowest performing area, however. Though it has recovered in the latest edition, Telangana still lagged behind the national average and saw a substantial drop in state ranking. The need for climate resilience and disaster preparedness was consistently identified as a significant challenge across all gap analysis, z-score analysis and benchmarking results. The sectoral validation also showed that there has been no corresponding improvement in renewable energy and forest cover with respect to climate adaptation and resilience measures.

The study finds that the progress made in environmental sustainability in Telangana has been uneven, with good results in energy and land use, but weaker results in climate action. The state needs to build on its strengths in clean energy and ecosystem conservation, while strengthening its focus on climate resilience, sustainable groundwater management and integrated resource governance to ensure balanced progress towards the 2030 SDG targets. The proposed Integrated Climate-Energy-Resource (CER) Governance Model provides a holistic approach to policy coordination between water, energy, climate and land sectors, which would help to achieve more sustainable and resilient development in Telangana.

Thus, the success of energy and land management alone is not enough to ensure environmental sustainability as a whole, as Telangana has shown. To achieve balanced progress towards the 2030 SDG targets, integrated governance is needed that can tackle climate resilience, water security, renewable energy expansion and ecosystem conservation.

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