

POLICY FRAMEWORK AND PREPAREDNESS

for Implementing Measures to Effectively Deal with Climate Change



An Analysis For
The State Of
KERALA

A study titled "Policy Framework and Preparedness for Implementing Measures to Effectively Deal with Climate Change: An Analysis of four states in India" was conducted through the support of the Heinrich Böll Foundation.

The assessment for the state of Kerala and the Union Territory of Lakshadweep is an extension of this mentioned study. The objective of the study was to assess climate change vulnerability of Kerala and Union Territory Lakshadweep. The aim of the study was also to understand the implications of the predicted Climate Vulnerability and Mitigation potential under various scenarios generated under the Intergovernmental Panel on Climate Change (IPCC) from the states' perspective.

Further, a detailed gap analysis was done to understand which actions, interventions and solution mentioned under the State Action Plan on Climate Change (SAPCC) (mandated under Ministry of Environment, Forest and Climate Change (MoEFCC)) were aligned with the IPCC AR5 report.

This pull out comprises of findings for the state of Kerala. It also lists out recommendations that have emerged from the study. It has been prepared to initiate the discussions at the state level, on the status of the implementation of their climate change action plans.

KERALA State Profile

Energy Profile

Kerala lies on the South Western coastal region of India between latitudes 8°17' and 12°47' North and longitudes 74°52' and 77°24' East. It is spread over an area of 38,863 sq.km, stretching 580 km in length and 30-130 km in breadth. It is flanked by the Arabian Sea on the west and the mountains of the Western Ghats on the east.

As per the Census 2011, Kerala's population is 33.3 million and accounts for 3.01% of India's population. The population density of Kerala is one of the highest in India at 859 persons per sq.km. Moreover, the population is spread across the state and as such there are no big urban agglomerations¹.

As per the quick estimates in 2012-13, the per capita Gross State Domestic Product at constant (2004-05) prices was ₹ 63491 as against provisional estimate of ₹ 59052 in 2011-12, recording a growth rate of 7.5 % in 2011-12. At current prices, the per capita GSDP in 2011-12 was ₹ 99977 registering a growth rate of 12.7 % over the previous year's estimate of ₹ 88713. It shows that during the period 2008-09 to 2012-13, the per capita state income at constant prices was higher than the per capita national income². During 2010-11, contribution from primary³, secondary⁴ and tertiary⁵ sector to the GSDP at constant prices (2004-06) constitute 14.94 %, 21.08% and 63.98%, respectively. Then share of agriculture and allied sectors in Kerala's GSDP has been declining with 14.30 % in 2011-12 and 13.76% in 2012-13⁶. High percentage employment can be seen in agriculture and services with 32.1% and 39.2% respectively, in the mentioned sectors⁷. This indicates the high susceptibility of population being affected by fluctuations in these two sectors.

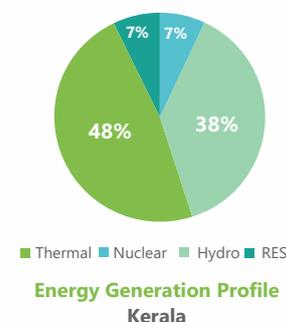
The installed power generation capacity in Kerala as on March 31, 2016 is 2880.18 MW⁸.

Source-wise Breakup of Installed Capacity in Kerala (in MW)

Ownership	Coal	Gas	Diesel	Total Thermal	Nuclear	Hydro (Renewable)	RES (MNRE)	Total
State	0.00	0.00	159.96	159.96	0.00	1881.50	145.02	2186.48
Private	615.00	174.00	0.00	789.00	0.00	0.00	193.70	982.70
Central	1108.18	359.58	0.00	1467.76	362.00	0.00	0.00	1829.76
Sub-total	1723.18	533.58	159.96	2416.72	362.00	1881.50	338.72	4998.94

Source: CEA, 2017

Of the total installed capacity 48% is through thermal generation that include coal, gas and diesel, where almost 71% is through coal. Generation through hydro follows a close second, accounting for 38% of the generation. Generation through renewable energy sources and nuclear, is of the similar order. The per capita energy consumption of the state is estimated to be around 565 kWh (KSEB 2015-16). As per the KSEB data, the state served 116.68 lakhs consumers in 2015-16 and the peak energy demand in Kerala was 3977.47 MW in 2015-16 (CEA, 2016-17)⁹.



Energy Statistics – Kerala

Per Capita Energy Consumption	565 kWh
Peak Energy Demand	3977.47 MW
Number of Consumers	116.68 lakhs
Energy Deficit	3.1% (2015-16)

As per the 24X7 Power for all Initiative¹⁰ of Kerala, about 3,55,578 households in rural areas and about 1,25,444 households in urban areas were un-electrified and the state had planned to electrify them completely under the Deen Dayal Upadhyay Gram Jyoti Yojana (DDUGJY)/ Integrated Power Development Scheme (IPDS) of GoI and through off-grid solutions. The DDUGJY statistics indicate that in 2017, Kerala is the first state in India to be completely electrified, including rural electrification¹¹.

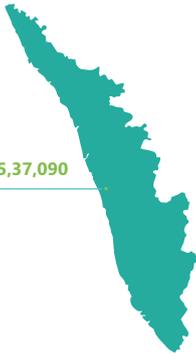
The state also has a nodal agency, called the Agency for Non-conventional Energy and Rural Technology (ANERT) that has programmes on renewable energy sources like solar, wind, etc.

This includes a '10,000 rooftop power plants programme', an off-grid rooftop scheme (target 10,000 rooftops ~10 MW) under which ANERT provides subsidies to households for installing solar rooftops.

UJALA Scheme Benefits – Kerala

Energy saved per year	16,28,154 MWh
Avoided peak demand	326 MW
CO ₂ reduction per year	13,18,805 t of CO ₂

Railways & KSEB 1,25,37,090



Total LEDs Distributed in Kerala

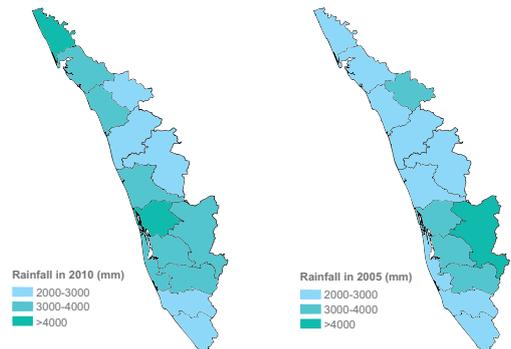
The state is also implementing the central Unnat Jyothi by Affordable LED's for All (UJALA) scheme. The scheme is aimed at promoting energy efficiency saving the electricity in the Indian states.

The vulnerability profile of the state looks more closely at the possible impacts of Climate change on the state focusing on the rainfall patterns as well as fluctuations. In addition, other vital parameters, such as occurrence of natural disasters like drought, cyclones etc. are also highlighted. Ground water availability is also a key area of concern related to potential vulnerability for states that has negatively impacted groundwater replenishment and high extraction.

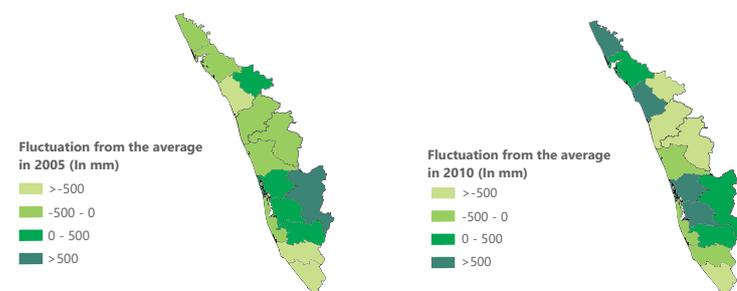
Vulnerability and Impacts

Kerala's climate is that of tropical monsoon with seasonally excessive rainfall and hot summer¹². The principal rain-giving seasons in Kerala are the South-West Monsoon (June-September) and North-East Monsoon (October-November). The State received record rainfall during post monsoon 2010. The rainfall pattern over the years of 2005 – 2010 (see map) shows that districts like Idukki, Kottayam, Thrissur, that are bordering Tamil Nadu have been receiving higher amounts of rainfall. The Northern side of the state including districts namely Kozhikode, Kannur and Kasaragod have drastically shifted to the high precipitation range. Districts of Ernakulam and Kasaragod have both graduated to higher ranges of precipitation from 2005 to 2010.

Rainfall Pattern



Rainfall Pattern of Kerala



Rainfall Variation In Kerala

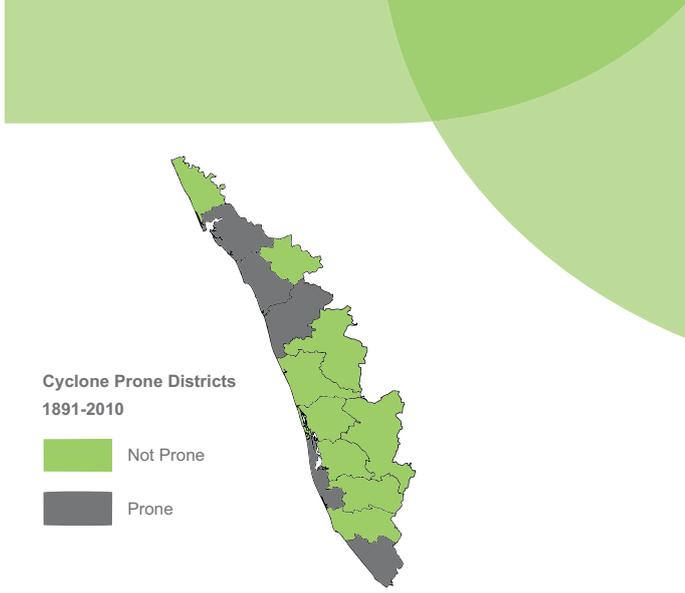
The fluctuation in rainfall, i.e. variation from the mean (see map) shows a varied pattern of inconsistencies within the districts. Kasaragod, Khozikode and Kottayam show a very high positive deviation (> 500 mm) from the mean rainfall in 2010 as compared to 2005, with very high rainfall being registered in these districts.

Rainfall Variation

The district of Ernakulam has consistently shown high deviation from the mean both in 2005 and 2010. Districts of Wayand, Malapurram Palakkad and Kollam have received rainfalls below the mean in 2010 as compared to 2005, with a very high negative deviation. Thiruvananthapuram has been in the similar range of negative deviation (> -500 mm) from the mean rainfall in 2010 as it was in 2005.

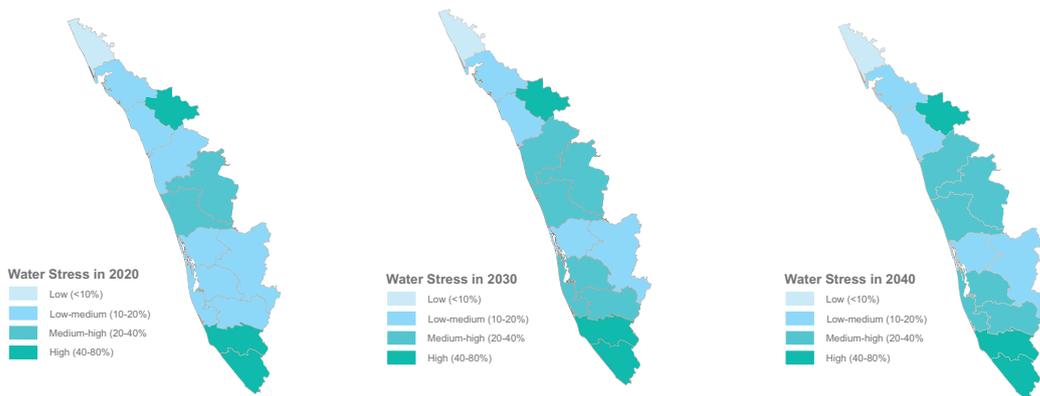


Owing to the geographical location of Kerala, with the Arabian Sea on one side, it is prone to storms and cyclone-related torrential downpours and rise in sea levels. This has not deterred urban settlements on the coastal lines as most of the Class I cities of Kerala are on its coastal line. The cyclone prone districts have been identified and constructed through ArcGIS. Based on the historical data of cyclones in Kerala, the districts have been identified as prone to floods or otherwise. Past cyclone data has revealed that districts of Kannur, Kozhikode, Malappuram, Alapuzha and Thiruvananthapuram are prone to incidents of cyclones.



Cyclone Affected Districts of Kerala

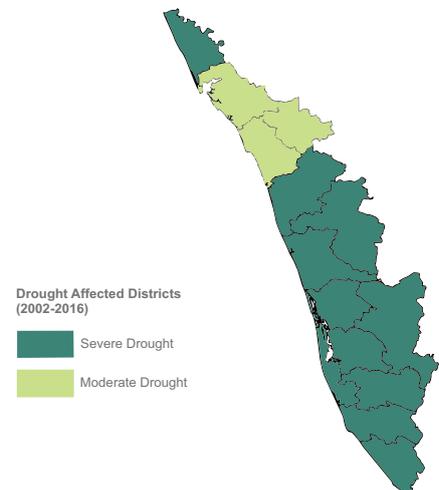
The groundwater stress (map below) indicates that even those districts that were categorized under “no stress” are approaching absolute water scarcity and hence, extreme groundwater stress levels, according to the 2040 projections. In the year 2014, 3 districts out of a total of 14 were identified as absolutely scarce in 2014. However, according to the 2040 projections, 6 districts out of the 14 would be in the 'medium-high' range and 3 districts would be in the 'high stress' range. Kasaragod, would continue, however, to be in the low water stress range.



Groundwater Stress In Kerala



In spite of a well-endowed precipitation, the state is also severely affected by droughts. Based on the data from 2002-2016, it is indicated that the whole state is drought prone and only three districts of Wayand, Kannur and Khozicode come into the moderate drought zone. Rest of the 9 districts from the 14 districts, i.e. 64% of the state is in the severe drought zone. In 2016, as per Kerala State's Meteorological Department the state was hit by the worst drought in 115 years with the North West Monsoon winds deserting the state between October and December, 2016.¹³



Drought Affected Districts of Kerala

Gaps & Status of Preparedness

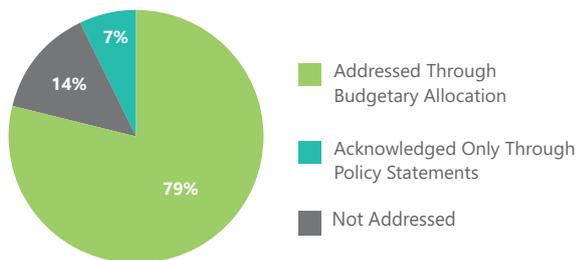
Climate Resilient Agriculture | Climate Resilient Ecosystem | Social Adaptation | Climate Resilient Infrastructure | Sustainable Water Management | Energy | Sustainable Smart Cities

This section looks at Kerala's state of preparedness with respect to seven categories mentioned above. The recommendations for each of these categories are based on references from IPCC, SAPCC, and the New Climate Economy report (NCE)¹².

Data sources for the Report -

Vulnerability maps have been prepared using Arc GIS and Quantum GIS software from the data gathered from:

Indicator	Data Source	Time Series
Rainfall fluctuations	IMD	2005-2010
Cyclones	IMD	1847-2004
Droughts	Farmers' Portal	2002-2016
Ground water Stress	CGWB	2010-2040 (Projections)



Recommendations Addressed Through Climate Resilient Agriculture In Kerala

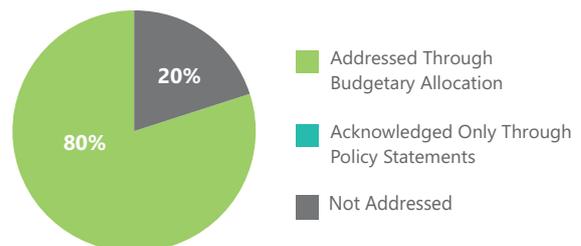
93% of the recommendations from the IPCC and NCE reports have been addressed through budgetary allocations and policy measures by various national and state specific policies and programmes. The National programmes include National Mission on Sustainable Agriculture, National Initiative on Climate Resilient Agriculture, National Green India Mission, Rashtriya Krishi Vikas Yojana, etc. Kerala has many state specific programmes operational for the promotion of agriculture and fisheries in the state.

Climate Resilient Agriculture

These programmes include State Horticulture Development, Crop Improvement and Management Plan, Matsya Keralam amongst others. Kerala has specific policy instruments too, that are in principle, targeted to the sustainable management and promotion of agriculture and fisheries, like The Kerala Conversion of Paddy Land and Wetland Bill, 2007, Kerala Water Policy, 2008, etc. 7% of the recommendations, have not been addressed such as reallocating spending from low-yielding subsidies towards education and extension services and rural infrastructure.

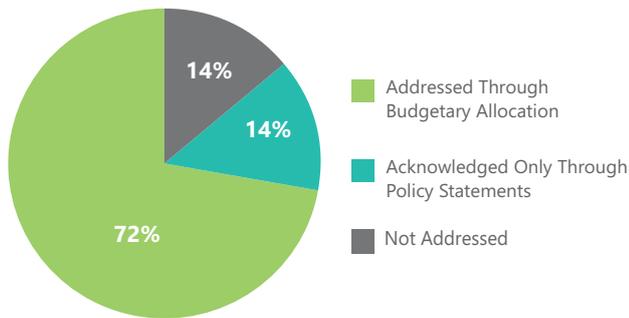
Climate Resilient Ecosystem

Kerala has 80% of its recommendations in this category, addressed through budgetary allocations and policy measures vis-à-vis climate resilient ecosystem. Apart from having urban development policies, Kerala also has policies for the promotion of agro-forestry like the Kerala Private Forests (Vesting and Assignment) Act, 1971 and Kerala Monsoon Fishing (Pelagic) Conservation Act 2007.



Recommendations Addressed Through Climate Resilient Ecosystem In Kerala

The state is also a beneficiary of central schemes like the National Mission for Green India under National Action Plan on Climate Change, Mangrove Conservation Project, National Mission for Strategic Knowledge for Climate Change under National Action Plan on Climate Change, etc. 20% of the recommendations have not been addressed that include recommendations like Payments for ecosystem services as an economic institutional adaptation measure, Assisted species migration and dispersal as an ecosystem adaptation strategy, etc.



Recommendation Addressed Through Social Adaptation In Kerala

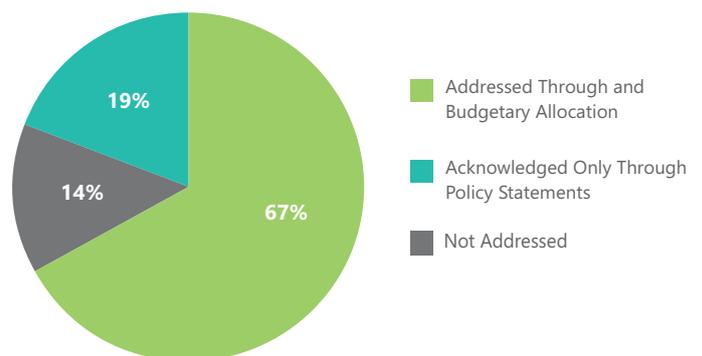
72% of the total recommendations have been addressed through budgetary allocations in the state of Kerala. 14% of the recommendations have been addressed through policy measures alone with no clear demarcation of budgetary allocations. The Kerala SAPCC has mentions of various measures through schemes and programmes to promote urban and rural development in the state. These include measures like collective farming through Kumdumbashree under the State Poverty Eradication Mission, encouraging group cooperation in certain farm operation with the support of agri-clinics and agri-business centres, fishery cooperatives, etc.



The measures under the programmes like National and state Health Mission have provisions like social mobilization to allow for better reach. 14% of the recommendations have not been addressed like use of indigenous climate observations as a social (informational) adaptation measure, have not been addressed.

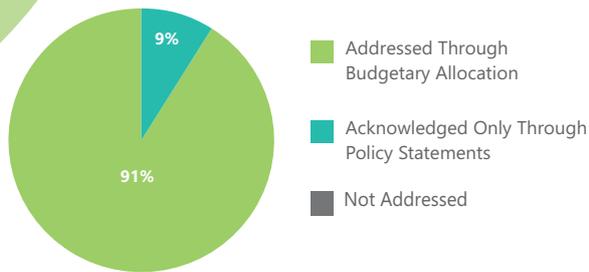


Provision and upgradation of infrastructure forms the part of most of the policies and programmes in Kerala's SAPCC. In total, 86% of the recommendations have been addressed through budgetary allocations and policy measures, of which 67% is through budgetary allocations alone. These recommendations are addressed through various policies in the state like Kerala State Disaster Management Rules (KSDMR), 2007; Kerala State Energy Conservation Building Code, 2017; Kerala State Housing Policy, 2011; Kerala Renewable Energy Policy 2002, etc. Many central programmes that are part of the NAPCC, have also been adopted by the state such as National Solar Mission, National Mission on Enhanced Energy Efficiency, Accelerated Power Development and Reform Programme, Jawaharlal Nehru National Urban Renewal Mission (JNNURM), etc. 14% of the recommendations.



Recommendation Addressed Through Climate Resilient Infrastructure In Kerala

Sustainable Water Management

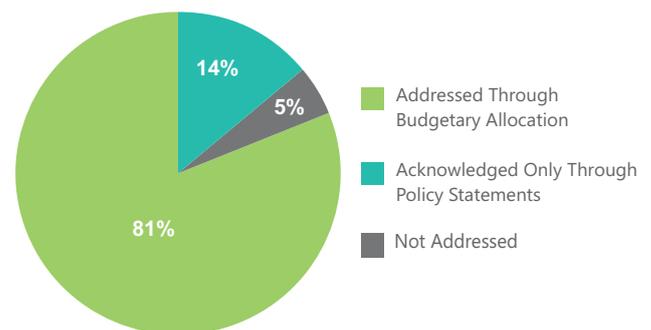


Recommendation Addressed Through Sustainable Water Management In Kerala

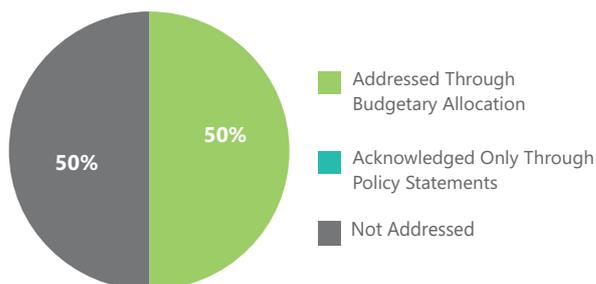
91% of the recommendations have been addressed through various budgetary allocations and policy measures. Kerala being a coastal state, has policies on water and its management (Kerala Water Policy, 2008) and river bank protection (The Kerala Protection of River Banks and Regulation of Removal of Sand Rules, 2002). This is also due to its vulnerability through shoreline erosion owing to heavy rainfalls and storms. It is a beneficiary of many national programmes such as the National Water Mission, National Hydrology Project, Rajiv Gandhi Drinking Water Mission, Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA), etc. Recommendations like Storm drain clearance as behavioural adaptation strategy, have been addressed through construction of storm drains in urban areas under the Kerala Sustainable Urban Development programme. However, it has been reported that the storm drainage project was not effective during the monsoon season in 2017¹⁴.

Energy

81% of the recommendations are addressed through budgetary allocations and policy measures, of which only 14% are just policy measures without budgetary allocations. Kerala has a state level policy on renewable energy (Kerala Renewable Energy Policy, 2002) and separately for solar energy (Kerala Solar Energy Policy, 2013). Programmes are also afoot for solar off-grid (Solar Smart - Off-grid rooftop solar power plants 2017-18) and grid connected (Solar Connect - Grid-tied Rooftop Solar Power Plants 2016-17) rooftops. The state is also undertaking a programme on bio-energy called Bio Energy Programme 2017-18 under National Biogas and Manure Management Programme (NBMMP). Kerala has recently implemented The Kerala State Energy Conservation Building Code, 2017 to facilitate green infrastructure building. 5% of the recommendations remain unaddressed that focus on substitution of coal to renewable energy sources.



Recommendation Addressed Through Energy In Kerala



Recommendation Addressed Through Smart And Sustainable Cities In Kerala

50% of the recommendations have been addressed through budgetary allocations and policy measures in Kerala through policies such as Kerala State Housing Policy, 2011 and National Urban Housing and Habitat Policy, 2007. Rest 50% of the recommendations have not been addressed. Reforms to achieve rent control laws (reform), better systems of appraise land values and determine property rights have not been recognized by the state.

Sustainable Smart Cities



RECOMMENDATIONS

The Kerala SAPCC in its current state, contains the right elements to mitigate impacts of climate change in the state. However there is a need for:

- Identifying sources for significant and sustained finance to implement many of the large-scale adaptation measures such as retrofitting core infrastructure assets that are at risk from extreme weather events.
- Developing frameworks for inter-departmental cooperation to ensure the implementation of the adaptation and mitigation strategies mentioned in the SAPCC.
- Developing frameworks for Monitoring and Evaluation of the existing and proposed schemes and projects to ensure that the resources are being utilised judiciously.
- Above all, there is a need for the development of short-term and long-term implementation roadmap especially to ensure the application of climate change adaptation measures.

Sources -

¹ Kerala State Action Plan on Climate Change (KSAPCC)

² ibid KSAPCC

³ Primary Sector would include i) Agriculture and allied activities (ii) Fishery (iii) Forestry (iv) Mining and Quarrying

⁴ Secondary Sector would include (i) Manufacturing (ii) Construction (iii) Gas, water and electricity supply

⁵ Tertiary sector would include (i) Trade, Hotels and Restaurants (ii) Transport, Storage and Communication (iii) Financial services such as Banking, Insurance etc. (iv) Real estate and Business services (v) Public Administration (vi) Others services

⁶ <https://kerala.gov.in/agriculture2>

⁷ Data-book Compiled for use of Planning Commission, June 3, 2014 (http://planningcommission.nic.in/data/datatable/0306/Databook_June2014.pdf)

⁸ Power System Statistics 2015-16 for Kerala, Kerala State Electricity Board Limited (KSEB)

⁹ Load Generation Balance Report 2016-17, CEA (<http://www.cea.nic.in/reports/annual/lgbr/lgbr-2016.pdf>)

¹⁰ Joint initiative by the Government of India and the Government of Kerala, Feb 2016

(http://powermin.nic.in/sites/default/files/uploads/joint_initiative_of_govt_of_india_and_Kerala.pdf)

¹¹ Status of rural electrification in Kerala, DDUGJY document August 31, 2017

(http://www.ddugjy.gov.in/mis/portal/state_wise_summary1.jsp?stateCode=32)

¹² Kerala SAPCC

¹³ Firstpost, Dec 2016, Kerala stares at worst drought in 115 years: State may impose water rationing system (<https://goo.gl/59cczM>)

¹⁴ The Hindu, June 28, 2017, 'Rain floods Mavoor Road' as accessed on 14.10.2017 (<http://www.thehindu.com/todays-paper/tp-national/tp-kerala/rain-floods-mavoor-road/article19158593.ece>)