

Radio Serial on Sustainable Development-Episode 28

ADDRESSING THE CLIMATE CHANGE, GREEN HOUSE GASES AND  
REDUCING EMISSION LEVEL

Dr E.R.Subrahmanyam,  
M.Sc.,M.Phil.,Ph.D

Anchor: Good Morning Listeners. You have been listening to a series of episodes on the theme 'Sustainable Development'. Climate change is the most significant challenge to sustainable development and it calls for urgent mitigation. Addressing the climate chaos by all countries individually and collectively will be critical to human wellbeing and prosperity of the present as well as the future generations as all nations and all people share the same atmosphere. The starting point for averting the dangers of climate change is to recognise the distinctive dimensions of the problem. Today we will bring you an episode on Climate change, causes, effects and the need for control.

Characters:

Surya (48) :	Professor-Husband	Dr Akash (44): Environmental Scientist
Dharani (45):	Environmental Activist-wife	Dr Teja (45): IITM Scientist
Varun (27):	Agricultural Officer-son	Meghana ( 21): Student
Sagar (52):	Farmer-Friend of Surya	Harita(20): Student

SCENE-1

Surya: Dharani, what are you doing? Bring a glass of water. I'm so thirsty.

Dharani: Here is the water. Why did you call me so loudly? I am listening to an interesting program on AIR.

Surya: I will tell you. First ,switch on the ceiling fan.

Dharani: Sorry. Power cut!

Surya: Oh, Very bad! We are having frequent power cuts this summer. It is so hot today .Very sultry and unbearable.

Dharani: Drink water first and use hand-fan.  
But today is Sunday and a holiday for your college. Why are you busy?

Surya: I forgot to tell you. Tomorrow we have a seminar in our college . I have to present a paper and participate in a discussion. I am preparing the paper.

Dharani: Ok. You are always busy. No time to chat with me even on a holiday. What can I do?

It's alright. Plz tell me " What is the topic of the seminar?"

Surya: It is an important topic, 'climate change'. You are participating in Swachh Bharat programmes and plantation programmes for environment protection of voluntary organisation. I hope you will like the seminar.

Dharani: Oh! Certainly. It is a very important topic. Our organisation will take up a campaign on water conservation in the nearby villages next week. As you know, drinking water problem is very acute in some villages as there are no rains. The wells are almost dried up. Farmers are also facing problems because of drought.

Surya: This summer is very horrible. This is last week of July. Still there are no rains Monsoon failed for the second consecutive year. I will include all these in my paper. Will you participate, Dharani?

Dharani: It's a seminar in your college. How can I participate?

Surya: The department of environment & forests is arranging the seminar. Students, farmers and voluntary organisations will participate as the topic concerns all.

Dharani: I am interested to participate. I listened to a radio talk on the topic yesterday. I may get more information through the seminar. Can I come along with you, tomorrow?

Surya: Oh yes! We both will go together a bit early. The seminar starts at 10 am. Of course there may be an exhibition by NEDCAP to promote solar pump sets, solar lamps, solar cookers, wind mills etc., outside the seminar hall.

Dharani: Ok. It's already 1 pm. It's time for lunch. Let's have lunch.

Surya: Wait for half an hour I will finish my paper.

Dharani: Ok. Mean while I will listen to a women's programme over AIR.

Surya: I am ready, Dharani. What are the items?

Dharani: Not many items .Vegetables are scarce in the market due to drought. Onions are being supplied in ration shops.

Surya: Ok. Have you contacted our son Varun?

Dharani: Yes. I talked to him on phone. He told me that Kolkata was also reeling under searing heat conditions.

Surya: So, the whole country is facing unusual weather. Dharani hot wind is blowing. Shut the window. See somebody is knocking at the door. You go and open the door.

Dharani: Oh, Kiran bhai! Please come in. Sit in the chair. I will bring water.

Kiran: Thank you sister. Is surya inside?

Dharani: Yes. He is taking lunch. He will come in 5 minutes

Surya: Kiran bhai, You look very tired and exhausted. It is very hot today. It's like an inferno? How could you come from your village?

Kiran: I have throbbing headache, nausea and vomiting sensation.

Surya: Oh, these are symptoms of mild sunstroke. Don't worry. First wash your face with cold water.

Dharani: I brought water and ORS packet. Kiran bhayya drink the ORS solution and relax for a while.

Kiran: Now I feel better.

Surya: Government already advised citizens not to leave their homes at noon unless it is very urgent.

Why did you take the risk at all?

Kiran: Surya, I received a notice from the bank here to repay my agricultural loan. You know, I cultivated groundnut and invested large amount. The crop withered due to drought. There are no hopes of getting any returns. How can I repay the loan? I wanted to talk to the bank officials and so came to the town. I can't move further. That's why I stopped at your house.

Surya: You should not take such risk. Any how you acted wisely. Government declared our mandal and some others as drought hit.

Loans will be rescheduled. Don't worry.

Kiran: What is this weather? This is the last week of July but there no rains till now. It is like extended summer. Some of my fellow farmers also sowed groundnut. Some others have raised chillies. Everybody is distressed. We are all losing the crops.

Surya: In fact we should have copious rains due to south-west monsoon from the 2<sup>nd</sup> week of June itself. But this year the monsoon failed . Heat wave is sweeping across the country.

Kiran: Drinking water has become a problem. Wells have dried up.

Government is supplying drinking water by tankers. But we are facing problems for our cattle. No water, no fodder. I will sell off my buffalos. I can't feed them anymore.

Dharani: In our town it s somewhat better. Municipality took some precautionary measures and stored water.

Kiran: Where is your son, Varun?

Surya: He is in Kolkata. He recently joined agriculture department and has gone there for training.

He will return in a week and join duty in our town.

Surya: Kiran ji, we are experiencing several hardships because of climate change. The heat wave and drought are part of climate change.

Kiran: Ok. I don't know why it is happening like this. Is there anything in our hands?

Surya: There is a good opportunity to learn many things. Tomorrow there is a seminar in our college. You can participate. Some farmers also will be there.

Dharani: I am also coming. Kiran bhai, don't miss it You can get lot of information about climate change and seek clarification on your doubts.

Kiran : Ok. Sister. I will go home and come tomorrow.

Dharani: Very good. It is 6pm. The weather somewhat cooled down. Wait for a while. I will bring butter milk for all. Tomorrow morning you start early. Travel by bus along with your farm guard.

SCENE ENDS.

SCENE-2

Surya: Good morning everybody. Students, kisans and environmental activists. I am Dr. Surya, Professor of environmental sciences. Today, we are organising the seminar on climate change and green house gas emissions in collaboration with IITM, NEDCAP and Dept. of E&F. This seminar is intended to create awareness about climate change and to put in place some measures to face the extreme weather conditions to minimise losses and hardships. We have with us scientists and experts who will give us vital information about causes and effects of climate change. It will be a discussion and you all can participate to make it useful.

Dr Akash: Good morning everybody. I am Dr Akash, environmental scientist. Prof. Surya has explained the purpose of this seminar. This year we are facing heat wave and drought. These and other extreme weather conditions are pointers to climate change worldwide. I must tell you that climate change is one of the

complex problems facing mankind today. The risks emanating from climate change are indeed profound and call for urgent mitigation.

Kiran: Sir, I am a farmer from a neighbouring village. As you know agriculture depends much on climate. This year there is drought. Last year there were untimely rains and floods. We lost our crops and landed in debts. What s all this sir.

Dr Akash: I already told you. This is due to climate change.

Kiran: Sir, what is climate change?

Dr Akash: Good question, Kiran ji. First let us know about weather and climate. Will anybody from the students tell me, 'what is weather?'

Meghana: Sir,I am Meghana, meteorology student. Weather is the state of the atmosphere with respect to wind, temperature, cloudiness, moisture, pressure etc.

Dr Akash: Well said, Ms Meghana. Weather can change from day to day, even hour by hour. It might rain one day and be sunny the next. Sometimes it is cold. Sometimes it is hot. Weather also changes from place to place.

Surya: I hope you all understood what Dr Akash said. Weather is the short-term state of the atmosphere at a certain place.

Kiran: Yes prof Surya .I understand. Then what is climate?

Surya: Now, I put this question also to our students. Harita, will you answer it?

Harita: Ok professor. Climate is the average daily weather for an extended period of time at a certain location.

Surya: correct . Climate is the usual weather of a place. It can be different for different seasons. Different places can have different climates.

Kiran: Now I understand the difference between weather and climate. Then, about climate change? please tell us

Surya: Ok Kiran. Dr Akash will answer your question.

Dr Akash: Everybody should know about it. Climate change is the change in the usual weather found in a place. This could be a change in how much rain a place usually gets in a year or it could be a change in a place's usual temperature for a month or season. Climate change is also a change in Earth's global climate.

Surya: So, when we are talking about climate change we are talking about changes in long term averages of daily weather.

Kiran: Now, it is clear. Is it true that Earth's climate is changing?

- Dr Akash: Why doubt, kiran ji? Monsoonal rains are absent and heat wave is sweeping across the whole country. You are the victims of drought this year. Your crops have withered. What more evidence you want?
- Kiran: Yes sir. Is the climate changing in other parts of the world?
- Dr Akash: Yes. Climate change is a global phenomenon. While we are experiencing heat wave conditions here, there are other weather extremes in other parts of the world. A clear evidence of climate change is the rising sea level. During the last century sea levels rose by 8 inches and now the rate continues to accelerate.
- Dharani: Sir, what are the other weather extremes?
- Dr Akash: Overall, the extreme weather events include tropical storms, hurricanes, heat waves, droughts, wildfires and devastating floods. These have been increasing in frequency and intensity around the world.
- Harita: I read in news papers that the intergovernmental Panel on Climate Change submits reports on global climate
- Dr Akash: Yes Ms Harita. The IPCC in its report noted that changes in many extreme weather and climate events had been observed since 1050. Some of these had been linked to human activities. The weather changes included a decrease in cold temperature extremes, an increase in warm temperature extremes, an increase in extreme high sea levels and an increase in the number of heavy precipitation events in a number of regions.
- Surya: The US National Oceanic and Atmospheric Administration reported that the year 2016 was the warmest year on record. NASA also confirmed this. With extremes including unprecedented heat in India and ice melt in the Arctic, average surface temperatures over land and oceans were 0.94 degrees Celsius above the 20<sup>th</sup> century average of 13.9 degrees Celsius.
- Dr Akash: Temperatures lifted both by man-made green house gases and a natural El Nino event that released heat from Pacific Ocean last year beat the previous record in 2015.
- Surya: We all must understand that climate change is the canvas on which history of the 21<sup>st</sup> century will be painted.
- Meghana: Sir, we all agree that the climate is changing. But what is causing climate change?
- Surya: The Earth's climate is dynamic. We must understand that many things can cause climate to change all on its own. Natural events like volcanic eruptions are one of the factors. Scientists say that humans can change climate too. We drive cars. We use air conditioners, refrigerators and hot air blowers. We cook

food. All these things take energy. One way we get energy is by burning fossil fuels i.e., coal, oil and natural gas. Burning these fuels puts some gases mainly carbon dioxide into the air. You know by burning these fuels we are putting nearly 30 billion tonnes of CO<sub>2</sub> into air!

Dharani: Surya Sir, Dr Akash mentioned about green house gases and El Nino. Now you are talking about CO<sub>2</sub>. These are all new to most of us. Would you please explain?

Surya: Oh. Sure. We have with us Dr Teja, a scientist from IITM. He will tell us many things.

Dr Teja: Good afternoon everybody. Today it is scientifically established that significant global warming is occurring. Global average air and ocean temperatures are increasing. This is due to green house effect. Gases such as Carbon dioxide, methane, nitrous oxide, ozone, chlorofluorocarbons, hydro fluorocarbons, sulphur hexafluoride and water vapour are responsible for this. These gases are called green house gases. However the main culprit is CO<sub>2</sub>.

Kiran: So, we are releasing these gases into the air and causing the green house effect.

Dr Teja: You are right, Kiran ji.

Dharani: We understand that human activities are mainly responsible for green house gas emissions.

Please explain what is meant by green house effect.

Dr Teja: Ok. It is a good question. It requires some detailed explanation.

Surya: Friends, It is time for lunch. Working lunch is arranged in college canteen for all participants. We shall meet again after lunch. The NEDCAP has set up exhibition of solar panels, solar water heaters and other solar gadgets. Please visit the exhibits and ask for details

Scene Ends.

(Lunch being served. Appropriate sounds.)

Surya: Ok Friends. Please follow me. We will visit the stalls. (Farmers and others visit the models of solar lanterns, solar water heaters, solar cookers, solar panels, wind turbines etc. exhibited by the Ministry of New and Renewable Energy.)....Sounds of footsteps..

SCENE-3

Surya: Welcome to second session. Hope you appreciate the exhibits.

- Kiran: Oh. The technicians at the stalls explained that all gadgets/devices work on nonconventional energy sources such as solar energy and wind energy. They told us about the government subsidy
- Surya: Friends, have you noticed that there is no power outside but the ceiling fans and mike are working here?
- Dharani: Yes,sir.We are facing power cuts. I think, educational institutions are exempted.
- Surya: No madam. No such exemption. We have set up a solar power plant with the help of NEDCAP in our college. solar power is used for class rooms and street lighting..
- Dr Teja: Congratulations. We have to encourage use of non-conventional energy for protecting environment. Now let us continue our discussion.
- Dharani: Sir, I asked you about green house effect.
- Dr Teja: Ok. I'm coming to that. Green house is a glass house. The roof of the glass house is permeable to radiations of the sun. Once inside the green house, the radiations strike a surface and are transformed into heat. The glass roof of the green house impedes the heat to pass out. Since much heat is trapped, the inside of the green house is warmer than the outside. This is called green house effect.
- Meghana: Then, how is it related to global warming, sir?
- Dr Teja: Like glass, a few gases chiefly CO<sub>2</sub> but also methane, nitrous oxide, ozone, water vapour and chlorofluoro carbons allow sun's radiations to pass through them and strike the surface of the earth. But like the glass roof of a green house, these gases block a large fraction of the earth's emitted radiation from escaping. The net result is that the earth's surface gets warming up. Thus global warming is called green house effect.
- Meghana: Sir, there are many green houses gases as mentioned by you. But why do you say that CO<sub>2</sub> is chiefly responsible
- Dr Teja: Good question Meghana. As I said the main influence is by CO<sub>2</sub> but the contributions of other GHGs, especially methane cannot be ignored. CO<sub>2</sub> accounts for around 75% of the warming impact of current human green house gas emissions while methane accounts for 14%. Nitrous oxide accounts for around 8% and fluorinated gases around 1% of human GHG emissions Thus CO<sub>2</sub> is the main contributor to global warming.
- Meghana: Sir, what is the role of water vapour in global warming?

- Dr Teja: In fact, water vapour is the biggest overall contributor to the green house effect.. But humans are not responsible for directly emitting this gas in quantities sufficient to change its concentration in the atmosphere. However, the warming caused by man-made emissions of CO<sub>2</sub> and other green house gases is increasing the amount of water vapour in the air by boosting the rate of evaporation.
- Dharani: So, green house effect is totally unwanted for the earth.
- Dr Teja: No No ,madam Dharani. Without the GHGs the earth would be as cold as the moon i.e, -18<sup>0</sup>C. By trapping the heat radiating from the earth's surface, the GHGs regulate the global temperature to life-sustaining 15<sup>0</sup>C. But if the concentration of GHGs, chiefly CO<sub>2</sub> increases too much, the Earth may share the same fate of its neighbouring planet Venus with surface temperature of 450<sup>0</sup>C.
- Kiran: So, it is necessary to monitor the CO<sub>2</sub> levels in the atmosphere.
- Dr TeJa: You are right, Kiran ji. Without realising the consequences of our actions we are causing GHG emissions. By burning fossil fuels we are putting so much CO<sub>2</sub> into the thin shell of air surrounding our world; we have literally changed the heat balance between the earth and the sun. According to the latest figures released by scientists at Mauna Loa observatory the CO<sub>2</sub> levels in the atmosphere have crossed 400 ppm. Other GHG emissions are also increasing.
- Meghana: Sir,Is the increase in the GHG levels abnormal?
- Dr Teja: I must give you some data. From 1970 to 2000, the concentration of CO<sub>2</sub> rose by about 1.5 ppm per year but since 2000, the annual rise has crept to an average 2.1 ppm. An important dimension is that carbon dioxide and other green house gases stay in the atmosphere for a long time. If no action is taken to reduce emissions, the concentration of GHGs in the atmosphere could reach double its pre-historic level as early as 2035, virtually committing us to a global average rise of over 2<sup>0</sup> C.
- Dharani: Sir,Why are the GHGs increasing in the atmosphere?
- Dr Akash: I will tell you Madam. A number of human activities, processes and consumptions produce GHGs. CO<sub>2</sub> emissions are mainly from fuel burning. Plants use large quantities of CO<sub>2</sub> in photosynthesis. As a result of deforestation an important sink of CO<sub>2</sub> is being eliminated. Nitrous Oxide is also produced in fuel burning. It is also increased by the use of nitrogen fertilisers and by the use of catalytic converters in automobiles. Methane is emitted by rice fields and cattle. CFCs are used as coolants in air conditioners and refrigerators.

Surya: Today, there is evidence that we are overloading the carrying capacity of the Earth's atmosphere. Stocks of GHGs in the Earth's atmosphere are accumulating at an unprecedented rate. Scientists believe that we have already crossed into a new weather regime marked by extremes of all kinds. It is predicted that in the course of 21<sup>st</sup> century, average global temperature could increase by more than 5<sup>0</sup>C. In effect, our generation is compelling future generations to inherit an unsustainable ecological debt, which will jeopardise the future development and prosperity.

Harita: Sir, Please tell us about El Nino.

Dr Teja: I will answer your question, Ms Harita. Under normal conditions the waters of Eastern Pacific off Ecuador, Peru and Northern Chile are surprisingly cold, as much as 10<sup>0</sup>C cooler than the waters of the Western Pacific. This part of the Eastern Pacific is teeming with fish since here cold waters rich in nutrients well up from the deep ocean. But every five to ten years from December to March, the waters of Eastern Pacific warm up a little i.e. 4<sup>0</sup>C higher than normal, which disrupts the upwelling of the rich, cold water. This in turn disrupts the anchovy fishery. This phenomenon is called El Nino.  
Meghana: Then, why are we concerned about it, sir?

Dr Teja: Very good question, Ms Meghana.

El Nino is not a localised phenomenon. Normally trade winds blow along the equator from the south-east pacific towards west pushing warm waters out to the sea. When El Nino comes along, these trade winds become weak and change direction from west to east i.e. the warm current starts to flow east. The warm water also warms the air, which lowers the atmospheric pressure and sparks torrential storms along Chile's coast reaching as far as Southern California. The weak low pressure system also changes rainfall pattern in the south-pacific which in turn leads to extensive droughts and heavy floods in other parts of the world such as India.

Dr Akash: El Nino is known to suppress the rainfall over India. The UN has declared 2015 as the hottest year on record and the El Nino that occurred in the year is classified as super El Nino. The opposite of El Nino is La Nina. It is observed to help monsoon and may also cause cyclones.

Meghana: Sir, is El Nino related to green house effect?

Dr Akash: Scientists know that El Nino contributes to increase of global temperatures but the link between green house effect and El Nino is still inconclusive.

Kiran: Sir, what are the consequences of global warming?

Surya: I will tell you, Kiran Ji. A slight increase in surface temperature, say 1<sup>0</sup>C, can adversely affect world's food production. The biological productivity of the

oceans would also decrease. Another effect is the rise in sea level by as much as 2 metres due to expansion of sea water at increased temperature, partial melting of glaciers, and ice caps of green land and also polar ice caps. This rise of sea levels would threaten coastal countries. Countries like Maldives, Bangladesh may be submerged. Coastal cities like Chennai, Goa may also meet similar fate.

Meghana: Sir, how does global warming affect climate?

Surya: Rising temperatures could alter climate radically. Some of the more fertile belts of North America and the Mediterranean could turn arid. In India some climate models predict a drop in wheat production in the fertile northern belt. More violent cyclones and floods are expected in the eastern coast.

Meghana: Sir, I believe that climate change affect bio-diversity.

Surya: Yes. You are right. Climate change may cause immense biodiversity loss. Both individual species and their ecosystems that support economic growth and human well being will be affected. A considerable number of today's known animal and plant species will be driven to extinction. Accelerated warming of the atmosphere will also alter the flora and fauna around the world.

Dharani: Sir, will there be any effect on health?

Surya: Yes. Climate change has a direct impact on human health. A warmer and more variable climate would result in higher levels of some air pollutants, increased transmission of diseases through unclean water and through contaminated food.

Kiran: Sir, I think climate change will adversely affect agriculture.

Surya: You are right Kiran ji. Climate change has significant impact on conditions affecting agriculture including temperature and precipitation. It can affect crop yield as well as the types of crops that can be grown in certain areas.

Kiran: Sir, please elaborate .

Surya; Ok. As you know agriculture requires some inputs such as water for irrigation, amounts of solar radiation that affect plant growth etc. Another factor is the prevalence of pests. Climate change shows its impact on all these.

Kiran: Ok It's now clear to me.

Dr Teja: Friends, have you heard about ozone layer depletion?

Meghana: I am aware of it. Ozone layer is in the stratosphere of Earth's atmosphere. There is a hole in the ozone layer.

Dr Teja: Ok. Ms Meghana. Ozone layer protects the Earth from the harmful UV rays of the sun. But emission of green house gases is responsible for the depletion of ozone layer. T results in higher exposure to the harmful radiations leading to an increase in the incidents of skin cancer and eye diseases such as cataract.

Kiran: Sir, I think climate change will affect poor people adversely.

Surya: Yes. The extreme weather conditions will cause livelihood insecurity to the poor people across the world. It will widen the gap between the haves and have-nots. We should also understand one. more thing. Today , it is the poor who are bearing the brunt of global warming and climate change. Tomorrow it will be humanity as a whole.

Dharani: So, the global warming resulting in climate change is a problem for the entire world.

De Teja: You are right madam, Dharani. Climate change challenge has a global scale. No one country can win the battle against climate change on its own. Collective action is not an option but a compulsion. We are making choices today that will affect our own lives, but even more so the lives of our children and grand children. We have the choice between forging ahead collectively with a shared perspective and hanging separately.

Kiran: Sir, my groundnut crop is withering due to drought. Can't we save it?

Dr Teja: why not? We will visit your village and your farm too. We will take some measures.

Kiran: Thank you, sir.

Scene Ends

SCENE-3

Kiran: Welcome Dr Teja, Dr Akash, Prof. Surya and Varun.

Dr Teja: Prof. Surya We will first visit the agriculture fields in the village to assess the damage to standing crops. We can submit a report to the government and recommend steps to save the crops.

Surya: Ok, Dr Teja. Dr Akash and I will accompany you. We will ask the farmers to assemble at panchayat office. We will note down the details from them.

Kiran: Sir, this is my farm. Please see the crop. It is almost dried up. Other crops such as chillies are facing the same fate.

Dr Akash: It is true. On our way from the town we have observed that the drought has caused extensive damage to crops in the entire region.

Varun: Kiran ji. Government is taking some emergency measures to save standing crops. Rain guns, tankers and fire engines will be used for wetting parched lands. So, You need not worry. Your crop will be saved by spraying jets of water.

Dr Teja: Our farmers should know about water conservation and rain water harvesting to cope with droughts.

Surya: It is also necessary to develop awareness about disasters due to climate change and stand prepared to minimise losses.

Dr Akash: Addressing climate chaos by all countries both individually and collectively will be critical to human wellbeing and prosperity of the present and future generations. At the international level, agreements are being reached to control green house gas emissions under Kyoto Protocol and Paris agreement to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below 2<sup>0</sup>C above the pre-industrial levels. The Paris accord is a historic agreement between the developed and developing countries to tackle climate change.

Kiran: What are the measures agreed upon, sir,

Dr Teja: Kiran ji, it is not possible now to go into the various measures and targets proposed under these agreements. We will organise another seminar soon to have a detailed discussion on these agreements. Some industrialists and businessmen will also be involved.

Kiran: Ok, sir.

Surya: At the local level we should take some steps to reduce green house gas emissions.

Dharani: We have taken up plantation programme in some villages.

Dr Teja: Very good. Plants are a very good sinks for atmospheric CO<sub>2</sub>. They take up CO<sub>2</sub> during photosynthesis and release oxygen. Plantation should be taken up as a people's movement. Government encourages the programme.

Kiran& other farmers: Thank you all sirs. Our hopes on the crops are revived.

Kiran: Please wait .It is very hot now. We have arrange tender coconut water. Please accept before going out.

Scene ends.

---

Dr E.R.Subrahmanyam, Principal (Retd), SKBR Post Graduate College, Amalapuram, East Godavari District, A.P., District honorary President, Jana Vignana Vedika