Reducing Humanity’s Carbon Footprint

Individuals can make changes, but significant reductions in greenhouse gases will mean making some changes, worldwide, of how energy is created, how land is managed.

To put the planet on a path of stable emissions, we need to, over the next 30 years, implement 8 of the following strategies. Each strategy involves tradeoffs. Which strategies do you pick?

**Efficiency & Conservation**

1. *Increased efficiency of cars*

   **GOAL**
   
   All cars in the world by must have a minimum fuel efficiency of 60 miles per gallon.

   **COSTS**
   
   This will require much more efficient engines and lighter weight vehicles.

2. *Reducing miles traveled by cars*

   **GOAL**
   
   Reduce the yearly number of miles traveled of every car in the world by half.

   **COSTS**
   
   This will require better urban planning, increased use of telecommunication, and more use of mass transit.

3. *Increasing efficiency of buildings*

   **GOAL**
   
   Increase (by 25%) efficiency of the space heating and cooling, water heating, lighting, and electric appliances in *all* new and existing residential and commercial buildings.

   **COSTS**
   
   This will require a dramatic increase in the efficiency of the buildings through insulation and other conservation measures.
Efficiency & Conservation

4. Increased efficiency of electricity production

GOAL
Double the efficiency of every coal plant in the world. (Coal is singled out because it is used to produce more electricity than any other fuel, and it releases more carbon per unit of energy.)

COSTS
A doubling of efficiency will require dramatic changes to the way coal is used to generate electricity.

Fossil-Fuel-Based

5. Fuel switching

GOAL
Retrofit 1400 coal-fired power plants to run on natural gas.

COSTS
This uses existing technology. Combined-cycle gas power plants produce much more energy per kilogram of carbon than coal plants. Nonetheless, this would be a major effort, and would increase costs.

Fossil-Fuel-Based

6. Carbon capture & storage (CCS)

GOAL
Capture all of the emissions of 800 coal or 1600 natural gas power plants and store the carbon dioxide underground.

COSTS
This is a technology that is still being developed. There are 3 pilot plants in the world. The technology would need to be scaled up and implemented very widely.
Fossil-Fuel-Based

7. **Coal synfuels with CCS**

**GOAL**
Produce liquid fuels for transport from coal, and capture the carbon dioxide released in the process. 180 plants would be needed.

**COSTS**
This is a technology that is still being developed. New technologies will need to be developed, scaled up, and implemented.

Fossil-Fuel-Based

8. **Fossil-based hydrogen fuel with CCS**

**GOAL**
Produce hydrogen fuel from fossil fuels, and capture and store all carbon dioxide. Currently, hydrogen is generally produced from natural gas. The scale of this production will need to increase by a factor of 10, and all carbon will need to be captured.

**COSTS**
We can produce hydrogen, but we need to develop reliable ways to transport it and safely use it to fuel cars.

Nuclear Energy

9. **Nuclear electricity**

**GOAL**
Triple the world production of nuclear energy.

**COSTS**
This is a proven technology, but it has risks associated with waste storage and the possibility of the diversion of fuel or waste to weapons production.
10. Wind-generated electricity

**GOAL**
Increase worldwide wind power capacity by a factor of 30 and displace a corresponding amount of coal-fired power plants.

**COSTS**
The area required for the windmills would be approximately the size of Germany. Wind turbines are cheap to operate, but they require huge up-front costs.

11. Solar electricity

**GOAL**
Increase worldwide solar electric power capacity by a factor of 700 and displace a corresponding amount of coal-fired power plants.

**COSTS**
The area required for the solar cells would be approximately the size of New Jersey. Solar cells are cheap to operate, but they require huge up-front costs.

12. Wind-generated hydrogen fuel for cars

**GOAL**
Install 4 millions windmills to produce hydrogen from water and use it to power vehicles.

**COSTS**
The area required for the windmills would be approximately the size of France. This would require changes to cars, fueling systems, and the development of new networks for distributing hydrogen fuel.
Renewable Energy and Biostorage

13. Biofuels

**GOAL**
Increase the worldwide production of ethanol for vehicles by a factor of 30.

**COSTS**
The cropland required would be approximately the size of India. This would have dramatic effects on world food production.

Renewable Energy and Biostorage

14. Forest storage

**GOAL**
Halt all reduction in forest cover worldwide.

**COSTS**
The countries where deforestation is taking place would need to be compensated.

Renewable Energy and Biostorage

15. Soil storage

**GOAL**
All cropland in the world would be managed to reduce carbon production.

**COSTS**
This would be quite difficult to implement.