

The Carbon Footprint Perspective

New Mexico

Supercomputing Challenge

Final Report

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Team 124

Saturday Science and Math Academy

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Executive Summary

Currently the concentration of carbon dioxide (CO₂) molecules in the atmosphere is 400 parts per million (ppm), while the “safe” level is 350 ppm. Every year 2 ppm of CO₂ are added to the atmosphere. The increased CO₂ in the atmosphere is not without environmental consequences. Just some of those consequences include more extreme weather events and lower crop yields.

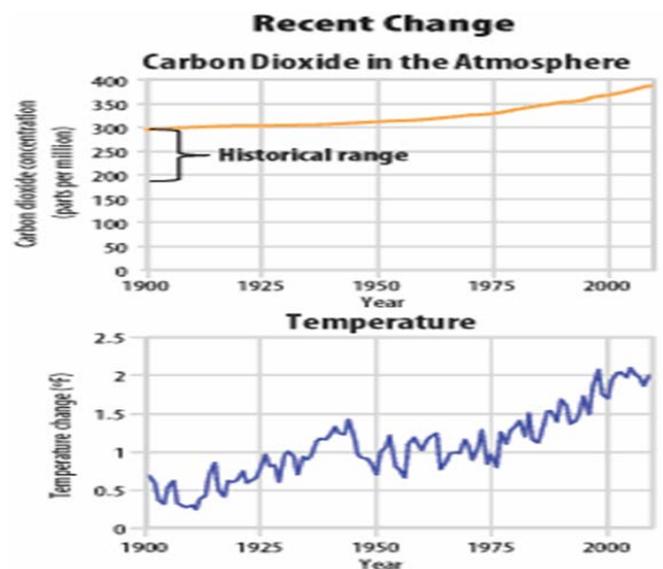
Our project aims to help raise awareness and educate people about the increasing CO₂ in the atmosphere by using an interactive website. Part of educating people is demonstrating how they can make a difference in a meaningful way. The website helps to emphasize how small changes add up, and can make a big environmental impact.

The Effects of Climate Change

As a result of an increase in the amount of CO₂ in the atmosphere the average global temperature is rising. Currently the concentration of carbon dioxide to other molecules is above the safe range for the earth. With the rise in temperature there are more extreme weather events, displacement of huge areas of land (over flow of water), increase in mosquito population causing disease to spread, and ecosystems will be thrown out of balance.

At this time, the concentration of CO₂ in the atmosphere is 400 ppm and rising about 2 ppm every year. According to the Environmental Protection Agency and notable climatologist Dr. James Hansen the safe level is at 350 ppm. For several years human development has increased CO₂ emissions due to factory emissions, automobiles, food production, and the elimination of carbon sinks by deforestation. From 2005 to 2014, 21.06 ppm of CO₂ was added to the atmosphere of the earth, compared to 10.56 ppm of CO₂ added between the years 1965-1974.

Part of curbing CO₂ emissions is to educate individuals even though the increase in CO₂ emissions is also influenced by the economy and the decisions of nations. Small changes of individuals can have a significant impact on CO₂ emissions. Unquestionably the amount of carbon dioxide in the atmosphere is increasing every year. Taking action and educating people will help improve the health of our environment.



By the Environmental Protection Agency
The relationship between increase in temperature and increase in carbon dioxide in the atmosphere.

Interactive Website

To help educate people on how to reduce their carbon footprint, we created an interactive website. Rather than many different resources online that attempt to raise awareness about this issue, our website uses game techniques or gamification. Gamification is the utilization of game techniques to improve the user experience and increase the time spent on a website. In addition to using gamification our website is aimed at a younger audience.

The premise of the game is that you are a carbon footprint consultant with a portfolio of clients. Living the life of a carbon footprint consultant means helping people make decisions in their daily life that will be more efficient in having less carbon dioxide emissions created due to certain choices. In this website, the person playing the game must give reasonable and effective advice to clients who want to improve their carbon footprint. They must be a carbon consultant who is informed and persuasive with their client.

Each client has 6 categories, each with 1 question. Clients asks the player a question about their lifestyle. Players have 4 options to suggest to a client, only 1 option the client will act on. Once the user picks the correct option the website will emphasize how the change the client made has a large impact. Your score is displayed on a graph. The graph shows how much carbon dioxide is in the atmosphere and the amount of carbon dioxide that would be in the atmosphere if every person in the United States made the changes your clients have.

The website educates people by displaying an interactive score. By using gamification and emphasizing how small changes can make a big difference the website helps to educate people about their impact on the amount of carbon dioxide in the atmosphere.

Client: Susan Wells

Starting Carbon Footprint: 48 tons of CO2 per year



Appliances and Electronics



Lighting



Recycling and Landscaping



Heating and Cooling



Transportation



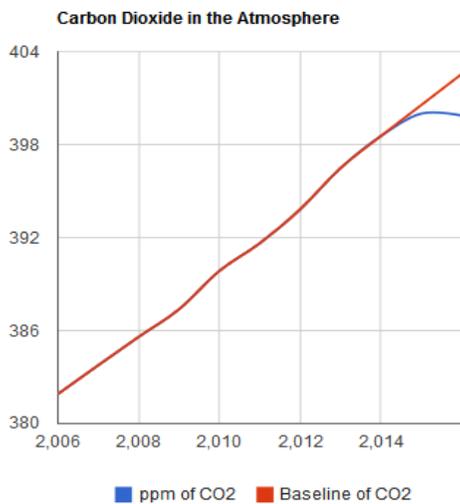
Food and Water

Picture of the website, categories for each question

The Impact You Have Made

How much saved per year: 4.5 tons of CO2

Carbon dioxide in the atmosphere: 399.7 ppm of CO2



The baseline of CO2 is the actual amount of CO2, and the projected CO2 in the future.

While the ppm of CO2 is what the ppm of CO2 would be if everyone in the United States made the changes your clients have made.

Picture of the website, graph and display of your score

Tools

The interactive website was programmed in HTML and JavaScript. JavaScript was used to program the main functionality of the website while the HTML was used for the appearance of the website. The website uses cookies to save stored information. We also used Google charts to program the line graph. The programming environment used was Eclipse Indigo.

Code

The website was programmed in HTML and JavaScript. This webpage is where we utilized Google charts to program the line chart and JavaScript embedded in HTML to display the users score.

```
<html>
<body>
<!-- Where the graph is displayed along with the main score in a pop up
window -->
<p><font size="5"><b>The Impact You Have Made</b></font></p>
<p><font size="3">How much saved per year: <span
id="score">0</span></font>tons of CO2</p>
<p><font size="3">Carbon dioxide in the atmosphere:<span
id="ppmscore">0</span> ppm of CO2</font></p>
<!-- Used for testing, see values for the graph <p><font size="3">PPM
Record:<span id="ppmRecord">0</span> ppm of CO2</font></p-->
<div id="curve_chart" style="width: 500px; height: 500px"></div>
<p>The baseline of CO2 is the actual amount of CO2, and the projected CO2 in
the future.</p>
<p>While the ppm of CO2 is what the ppm of CO2 would be if everyone in the
United States made the changes your clients have made.</p>
</body>
</html>
<script src="cookies.js"></script>
<script src="addtoScore.js"></script>
<script>
//sets the score and data for the graph
    function refresh() {
        score = docCookies.getItem("score");
        document.getElementById("score").innerHTML =
String(parseFloat(score).toFixed(2));
        ppmscore = docCookies.getItem("ppmscore");
        document.getElementById("ppmscore").innerHTML =
String(parseFloat(ppmscore).toFixed(4));
        ppmRecord = docCookies.getItem("ppmRecord");
        document.getElementById("ppmRecord").innerHTML = ppmRecord;
    }

    if (!docCookies.hasItem("score")) {
        //Set to the default portfolio the first time around
        docCookies.setItem("score", 0)
    }

    if (!docCookies.hasItem("ppmscore")) {
        //Set to the starting parts per million
        docCookies.setItem("ppmscore", 400)
    }
    if (!docCookies.hasItem("ppmRecord")) {
        //Set to the starting parts per million
```

```

        var ppmRecord =
[381.9,383.76,385.59,387.37,389.85,391.63,393.82,396.48,398.55];
        docCookies.setItem("ppmRecord",JSON.stringify(ppmRecord));
    }
    function setppmRecord()
    {
        var ppmRecord =
[381.9,383.76,385.59,387.37,389.85,391.63,393.82,396.48,398.55];
        docCookies.setItem("ppmRecord",JSON.stringify(ppmRecord));
    }

    refresh();
</script>
<!-- Code for graph from google charts -->
<script type="text/javascript"
    src="https://www.google.com/jsapi?autoload={
        'modules':[{
            'name':'visualization',
            'version':'1',
            'packages':['corechart']
        }]
    }"></script>

<script type="text/javascript">
    google.setOnLoadCallback(drawChart);

    function drawChart() {
        dataArray = [['Year', 'ppm of CO2', 'Baseline of CO2']]
        ppmRecord = JSON.parse(docCookies.getItem("ppmRecord"));
        ppmRecordLength = ppmRecord.length;
        for (var i=0; i < ppmRecordLength; i++){
            Year = 2006 + i;
            if (Year < 2015){
                Baseline = ppmRecord[i];
            }
            else {
                Baseline = 398.55 + 2*(i-8);
            }
            dataArray.push([Year, ppmRecord[i], Baseline]);
        }
        var data = google.visualization.arrayToDataTable(dataArray);

        var options = {
            title: 'Carbon Dioxide in the Atmosphere',
            curveType: 'function',
            legend: { position: 'bottom' }
        };

        var chart = new
google.visualization.LineChart(document.getElementById('curve_chart'));

        chart.draw(data, options);
    }
</script>

```

This page displayed the appliances question for client 1. All of the question pages followed this outline for the JavaScript of the code; the text in the HTML was changed to match each client.

```
<html>
<!-- The page used for all HTML outline used for all of the questions -->
<head>
</head>
<body>
<table align="center">
<tr>
<td rowspan="2" colspan="2"><h1>Appliances</h1></td>
<!-- Appliances question for client 1 -->
</tr>
<tr>
<td><a
href="JavaScript:newPopup('http://michaelbluejay.com/electricity/refrigerator
s.html')">Need Help?</a></td>
<td><a href="JavaScript:newPopup('http://www.epa.gov/cleanenergy/energy-
resources/calculator.html')">Want to Learn More</a></td>
</tr>
<tr>
<td><b>My refrigerator is 30 years old. What do you suggest?</b></td>
</tr>
<tr>
<td>
<div>
<!-- Options user can suggest to client -->
<input type="radio" name="refrigerator" value="refrigerator_A" id="A"
onClick="addToScore(3)">Replacing your old refrigerator with an Energy Star
model would save you over $180 per year<br>
<input type="radio" name="refrigerator" value="refrigerator_B" id="B"
onClick="nope()">They don't make them like they used to, keep your old
refrigerator<br>
<input type="radio" name="refrigerator" value="refrigerator_C" id="C"
onClick="kinda()">A new energy efficient refrigerator could be as much as 25%
more efficient than your old one<br>
<input type="radio" name="refrigerator" value="refrigerator_D" id="D"
onClick="tried()">Don't get a new fridge, just clean the coils<br>
</div>
</td>
</tr>
</table>
<br>
<br>
<br>
<table align="right">
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><a class="text" href="client1categories.html"> Go Back</a></td>
</tr>
</table>
</body>
</html>
```

```

<script src="cookies.js"></script>
<script src="addtoScore.js"></script>
<script>
//Client tailored responses for each incorrect answer
function nope ()
{
    alert("Really?")
}
function kinda ()
{
    alert("Isn't worth it, I'll just keep the old fridge")
}
function tried ()
{
    alert("I already did that!")
}
function newPopup(url){
    popupWindow = window.open(url,'popUpWindow','height=700, width=800,
left=10, top=10, resizable=yes, scrollbars=yes, toolbar=yes, menubar=no,
location=no, directories=no, status=yes')
}
</script>

```

This JavaScript document is used to update the score and the chart.

```

function addToScore(reductionAmount)
//Updates score and updates list for the values of the graph, happens if the
question is correct
{
    USpop= 318900000;
    tons2ppm = 1/(7.81e9);
    score = parseInt(docCookies.getItem("score"));
    docCookies.setItem("score",score+reductionAmount);
    score = parseInt(docCookies.getItem("score"));
    alert("I'll do it!");
    ppmscore = docCookies.getItem("ppmscore");
    docCookies.setItem("ppmscore",parseFloat(ppmscore)-
(USpop*(score*tons2ppm)));
    ppmRecord = JSON.parse(docCookies.getItem("ppmRecord"))
    ppmRecord[ppmRecord.length]=ppmscore
    docCookies.setItem("ppmRecord", JSON.stringify(ppmRecord))
    window.location="client1categories.html";
}

```

Future Plans

A short term goal is to publish our website and our final report online. A long term goal to improve the website is to add more clients and create our own images for each client. Another long term goal is to create a more interactive story line, for example when the user significantly reduces the ppm of CO₂ in the atmosphere a good event takes place. To improve the graph we would add a third curve for the safe level of CO₂ in the atmosphere.

Works Cited

- 1) CO₂ Now website: <http://co2now.org/>. (2015)
- 2) 350 Global Climate Change Movement website: <http://350.org/about/science/>. (2014)
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- 5) The Environmental Protection Agency website: <http://epa.gov/climatestudents/basics/past.html>. (2015)
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- 7) Supercomputing Challenge website: <http://www.supercomputingchallenge.org/>. (2015)
- 8) Google Charts: <https://developers.google.com/chart/>. (2015)
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