



Summative Evaluation

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Earth: The Operators' Manual Summative Evaluation

Project Description

"ETOM is an innovative hybrid model of science communication that combines the power and reach of broadcast television and online video with the immediacy and impact of visually-rich in-person presentations at science centers and museums, extended further through the ongoing engagement and connectivity of Web 2.0 social networking."

Earth: The Operators' Manual (ETOM), an NSF-funded initiative developed by Passport To Knowledge, takes a multi-pronged approach to presenting information and ideas focused on climate change and sustainable energy content for different audiences. The project team developed four types of media experiences to share information with the public and encourage them to engage in dialogue and take action to address issues of energy demand, climate change, and sustainable alternatives: Television programs, museum outreach events, a project website, and social media initiatives.

ETOM developed three complementary television programs for broadcast on PBS. Program One, *Earth: The Operators' Manual*, provided evidence of manmade climate change, set up the problem of energy demand, and examined several potential sustainable energy solutions. Program Two, *Powering the Planet*, focused on more in-depth examples of countries and communities who are utilizing sustainable energy alternatives and the challenges they face in implementation. Program Three, *Energy Quest USA*, looked at five different communities in the United States and the energy choices they made based on environmental and economic concerns. Program One first aired in April 2011. Programs Two and Three aired a year later, in April 2012 (along with a re-airing of Program One). The initial airing of each program, according to the national PBS schedule, coincided with PBS's Earth Week programming in celebration of Earth Day. All programs were hosted by Richard Alley, a highly-respected climatologist from Penn State University.

ETOM's museum outreach events began in March 2011, corresponding with the initial airdate for Program One. Five museum partners agreed to facilitate ETOM outreach events at their institutions: the Science Museum of Minnesota, the Oregon Museum of Science and Industry, the Fort Worth Museum of Science and History, the North Carolina Museum of Natural Sciences, and the Reuben H. Fleet Science Center in San Diego. Museum events took various forms, from program screenings to spoken word presentations by Richard Alley and other speakers, to Science Cafes (see Figure 1) and outdoor festivals.

The ETOM website was initially launched in April 2011, also in conjunction with the broadcast of Program One. The website was redesigned in 2012, and relaunched on April 16th of that year to coincide with the rebroadcast of Program One and the original airing of the two new programs. The website contained streaming video of the full programs, each of which was also available in short "chapters," information about program airings on television, short web-exclusive video clips that may not have been in the broadcast,

quizzes, widgets with interactive energy-saving tips for consumers, links to other ETOM resources and events, and more in-depth climate change and sustainable energy content.

The project team created its first Facebook post on March 5, 2011, aligned with the initial broadcast of Program One. ETOM increased its social media presence in April 2012, to coincide with the relaunch of the website and program airdates. ETOM Facebook posts included quotes from scientists, politicians, and sustainable energy advocates, tips for individuals to reduce their energy consumption, examples of communities implementing sustainable energy initiatives, and facts and figures with climate change and energy use content.

Figure 1: Richard Alley Speaking at the OMSI Science Pub (courtesy OMSI)



Methods and Approach

Rockman et al (REA), the external evaluators for the project, worked in collaboration with the ETOM project team to devise methods for examining the impact of each of the four strategies for disseminating ETOM content (television programs, museum outreach events, website, and social media), and to examine the “additive contribution” of all four working together. REA utilized qualitative and quantitative approaches to consider the degree to which each of the four ETOM media were addressing the following audience impacts:

- Increasing interest in ETOM content topics
- Learning new information about climate change or sustainable energy
- Changing participants’ perspectives on environmental issues
- Increasing the likelihood of taking action to reduce individual energy consumption
- Increasing the desire to seek out further resources or information on ETOM content topics
- Increasing the likelihood of having discussions about ETOM topics with others

REA investigated the extent to which television program viewers, museum event attendees, website visitors, and Facebook users experienced the above outcomes by collecting information from these audiences via post-surveys, interviews, focus groups, on-site observations and online analytics (see *Appendices A-D* for sample instruments). Using these tools, REA also collected information about how participants found each ETOM resource, why they decided to engage with it, what portions of the programming participants viewed or visited, what they enjoyed about the experience, and whether anything was missing from the experience. These data collection tools and questions allowed REA to collect and analyze a broad range of qualitative and quantitative data, exploring the impact that the intertwined ETOM resources had on their audiences. The anonymous audience quotations presented in this report were selected as representative of the overall findings.

Findings are discussed first as broad overall audience impacts and comparatively by media experiences, then broken down further into the experiences of different audiences with each type of ETOM media.

Figure 2: ETOM Host, Richard Alley, at Hells Gate Geothermal Park, Rotorua, New Zealand



Overall Findings

Project Impacts

“What I found most useful about this program is that it brought the science to a much more manageable level, so you could have a good cocktail conversation with this information because he's giving you metaphors for it and breaking it down in ways you can remember...so I think it brings it into the public discourse if you're able to understand these issues in a conversational level.”

The magnitude of ETOM's impact differed significantly, depending on the method of dissemination. The overall impact of ETOM's multiple mediums was greatest in encouraging participants to have discussions about relevant topics with others. For example, individuals noted that they *“learned more about ways to communicate science.”* Participants, regardless of the specific ETOM resource they encountered, indicated that they wanted to share ETOM information with friends and family members, skeptics and, in the case of educators, with their students. They saw ETOM as a *“great tool to open family discussions on what we can do as individuals and, on a broader spectrum as a community to change our behaviors.”* ETOM also affected participants' interest in the topic and made them want to seek out further resources and information. These findings emerged from participant surveys about the television programming, website, and museum events.

ETOM media had the least impact in changing participants' perspectives on environmental issues. Changes in viewpoints would have been difficult, given the starting point of most of the study's participants. More than two-thirds (69%) were “very” to “extremely sure” that climate change is happening, which mirrors recent *Six Americas* data regarding the overall population (Leiserowitz, Maibach, Roser-Renouf, & Hmielowski, 2012). This data suggests that most viewers/participants sought out ETOM because they were previously interested in the topic of climate change. Although ETOM's audience was already engaged with the topic, they expressed a desire to share the information presented with others and felt empowered to do so. Thus, although ETOM resources were not often directly consumed by skeptics, these people may have still heard the message or been shown ETOM resources by others and been reached as a secondary audience.

The television programs were the most effective at increasing participants' interest in the topic and providing them with new climate change and sustainable energy information. *“[The host was] very enthusiastic about the topic, presented factual knowledge that was covered in some depth, and provided a different type of perspective than I had seen before in discussions on global warming.”* This view fit well with the goals of the television programs, as the programs were dissemination mechanisms for information. The television programs also engendered the largest self-reported change in perspectives on the importance of environmental issues, although as mentioned above, none of the methods were particularly effective in changing climate change beliefs.

Website visitors were more willing to take action, seek out new resources, and felt more encouraged to have discussions than did museum event attendees or television program viewers. One noted: *“I learned that I'm already doing well reducing my energy consumption,*

but that there is more I can do.” This perspective is aligned with the purpose of the website, which was designed to offer information, and also provide visitors with conversation starters, engaging resources, and action items.

Museum event attendees reported that the events encouraged them to have discussions with others about the topic. An attendee said, *“The program gave us language that we can use to communicate to other people.”* This makes sense, given that these in-person events were more social in nature and several events had opportunities to engage in question-and-answer sessions with speakers. However, the impact of the museum events was the lowest across every indicator. In many cases these differences in perceived impact were statistically significant in paired comparisons between the website or television program and the museum event. The museum events most likely had less overall effect on the audience than the other dissemination mediums due to the differing content emphases, formats, and audiences served at individual events. For example, lectures by Richard Alley strategically focused on evidence for manmade climate change, whereas military presentations dealt with the US Army’s, Marines’ and Navy’s use of sustainable energy alternatives. Each event was designed for the specific, local audience, and thus the composition of museum events differed. Results from event attendees are presented in aggregate in order to utilize the largest number of responses in the analysis and draw comparisons between museum events and the other methods of dissemination.

The data in Table 1, below, are from participant surveys that have been aggregated for this analysis. Survey respondents were asked to indicate their level of agreement regarding whether a particular ETOM resource (television program, website, or museum event) had impacted them in seven different areas, on a scale from 1 to 4 with 1 being “Strongly Disagree” and 4 being “Strongly Agree.” Respondents’ mean level of agreement is listed in Table 1 below. They could only give one rating per impact per medium of dissemination. The data form the basis for the discussion in this section, but are not the only sources of information to inform the findings and conclusions of this report.

As shown in Table 1, overall, ETOM resources were most impactful in encouraging participants to have discussions with others, increasing interest in the topic, and making participants want to seek out further topical information. When comparing various mediums for ETOM content dissemination, ETOM television programming was most effective in increasing participant interest, providing new information about climate change and sustainable energy and changing participants’ perspectives on environmental issues. The ETOM website was most effective in encouraging participants to take action, increasing the desire to seek out related resources, and supporting topical discussions with others. ETOM museum events were less impactful than other mediums.

Table 1: Comparison of ETOM Impacts By Medium of Dissemination

Impact	Overall Mean	ETOM Website Mean	ETOM Television Program Mean	ETOM Museum Event Mean	Significance Level
Encouraged me to have discussions about this topic with others.	3.27	3.46	3.22	3.23	.001*
Increased my interest in this topic.	3.21	3.21	3.44	3.19	.024*
Makes me want to seek out further resources or information.	3.20	3.35	3.27	3.15	.006*
Gave me new information about climate change.	3.03	3.06	3.36	2.99	.005*
Gave me new information about sustainable energy.	2.98	3.07	3.38	2.92	.000*
Encouraged me to take action.	2.97	3.24	3.07	2.88	.000*
Changed my perspective on environmental issues.	2.35	2.34	2.61	2.33	.058

* Indicates a significant difference across the three means (website, television, museum) at the .05 level, using a one-way ANOVA.

Content Learned

REA researchers also coded and analyzed participants’ open-ended responses to survey questions, asking specifically what new information about climate change or sustainable energy they had learned. Participants seemed to answer this question with specific, meaningful facts (i.e. “Energy! Who knew? Houston #1 user of sustainable.”); this likely skewed their answers slightly to the most memorable, rather than simply any new information. There were some significant differences in what participants reported they had learned based on which ETOM media they had encountered (see Table 2). Website visitors tended to share significantly more specific facts about climate change and indicated that they had learned something about personal actions they could take to reduce their energy consumption than museum event attendees (see *Appendices E-G* for examples of the kinds of information ETOM participants learned by media type.) This result reflects the website’s greater emphasis on individual actions and the differing speakers and content focus of the museum events. Due to the low number of respondents to this question, we did not see significant differences for television viewers. These findings differ slightly from participants’ agreement that they learned something new about climate change or sustainable energy because the current question requested specifics, as opposed to agreement with a general statement. Social media was not included in this analysis because the specific learning question was not asked.

Table 2: Content ETOM Participants Mentioned Learning By Medium

Content	Overall Mean	ETOM Website Mean	ETOM Television Program Mean	ETOM Museum Event Mean	Significance Level
Sustainable Energy	.39	.38	.54	.38	.157
Climate Change	.33	.43	.43	.28	.010*
Military Energy Applications	.13	.19	.06	.12	.087
Personal Actions To Reduce Energy Use	.01	.03	.00	.00	.007*

* Indicates a significant difference across the three means (website, television, museum) at the .05 level, using a one-way ANOVA.

Overall Opinions of ETOM Resources

In general, the participants felt that ETOM presented credible experts (see Figure 3), compelling visuals and fact-based information that was easy to understand and “*solidly solutions-focused*” throughout the four types of media. One person stated, “*I felt like it was the most thorough or just the most clear explanation of linking carbon dioxide to climate change.*”

Across all types of media, audience members appreciated that ETOM’s approach was positive. For example, “*The methods are very fresh and appealing for general audiences...It’s very upbeat and focused on solutions.*” One Facebook user described ETOM as, “*More cheery and optimistic than most stuff on climate, which reflects Richard Alley’s style. Sort of a ‘we can do this’ approach rather than doom and gloom.*” Similarly, audiences engaged with ETOM resources were also interested in actions that they could take and finding out information on possible solutions and new approaches for addressing energy demand.

Most liked that the information presented by ETOM “*address[es] global warning deniers and skeptics, instead of assuming, ‘Okay, we all know there is global warming and we will skip the proof and go on to the next question.’*” Many ETOM consumers were energized by the resources and ideas presented and excited to share them with others or use them as part of the ongoing climate change debate. There is overwhelming evidence that participants wanted to share ETOM resources with friends, family members, co-workers, and skeptics; “*ETOM is a great resource especially in encouraging others to participate and educate themselves in green initiatives.*” Several teachers also discussed the various ways that they could use ETOM resources in the classroom; “*I shared with my AP Environmental Science class. It really helped to tie Energy Resources and Climate Change together in a nice manner. We had a great discussion of green energy sources as well.*”

Many viewers and users felt the ETOM materials were politically neutral. One program viewer explained, “*That was just science with no political leanings.*” While most participants acknowledged that climate change is a political topic, they were pleased overall with ETOM’s fact-based approach, which stayed above politics. In sum, those who engaged with ETOM saw its resources as an effective toolkit for accumulating evidence and sharing that information with others.

Figure 3: Rear Admiral David Titley Explaining Findings from the Pentagon’s Quadrennial Defense Review in Program One



ETOM Television Program Findings

“This was the most succinct, clear, but comprehensive discussion of the threat I have heard. It was the most thorough exposition of potential positive solutions...It gave me hope, which I had lost.”

Program viewers were recruited throughout the duration of the ETOM project to provide feedback on the three television programs via surveys (see Figure 4). Invitations to complete the survey were distributed by PBS stations around the country via email, newsletter, Twitter, and Facebook, after the first program aired. REA obtained further information about the television programs from surveys posted on ETOM’s website and Facebook page, as well as from surveys passed out after ETOM museum outreach events. Focus group participants in four different cities gave feedback on early versions of Programs One and Two, providing reactions to the format, tone, host, and program content in more depth.

Figure 4: ETOM Host, Richard Alley, About to Descend into a Crevasse to Point Out Layers in the Snow and Ice of the Franz Josef Glacier, New Zealand



1,045 adult respondents completed a survey and answered at least one survey question about the ETOM television programs. 54 adults participated in Program One focus groups, with an oversampling of those with military affiliations and professional educators, while 17 adults participated in Program Two focus groups. The Program One audiences were chosen because of the program’s potential for classroom use and the presence of a segment on military uses of alternative energy sources. The focus groups were held in four sites: Program One in Fort Worth, TX and New York City, NY; and Program Two in Philadelphia, PA and Louisville, KY.

ETOM Television Program Viewing

958 survey respondents were asked whether they had watched an ETOM television program. Of these, 15% indicated that they had watched at least one ETOM television program and were asked further questions about the programs. Most viewers reported that they learned about the programs from an email (41%, see Table 3). It is unclear whether respondents were referring to the survey invite emails, which may have encouraged them to view the programs before completing the survey, or emails from PBS station affiliates.

Of those who watched an ETOM television program, slightly more saw that program live on PBS (38.5%) than online (30%, see Table 4). Survey respondents were most likely to have viewed Program One (see Table 5), but this result may be skewed by surveys that were collected before the airing of Programs Two and Three. Nielsen ratings for PBS revealed that Program One was viewed on television more often than Program Two (over 2.1 million viewers vs. 1.5 million viewers, respectively). No Nielsen ratings were available for Program Three. This result may be due to Program One airing both originally and as a rerun.

Most viewers watched an ETOM program due to an interest in the topic (88%) and an appreciation of PBS programming (50%, see Table 6).

Table 3: How Did Viewers Hear About the Program? (N=51)*

	Email	Social Media	Channel Listings	ETOM Website	Channel Surfing	Museum Event	Television Commercial	Newspaper
Number of Respondents	21	9	9	8	6	5	4	4

* Respondents could list more than one method.

Table 4: How Did Viewers Watch the Program? (N=130)*

	Live on PBS	Online	DVR	Museum Event	On DVD	Other- Did Not Specify
Number of Respondents	50	39	15	15	10	5

* A few respondents watched the program in more than one way.

Table 5: What Programs Did Viewers Watch? (N=58)

	Program One	Program Two	Program Three
Number of Respondents	51	27	19

Table 6: Why Did Viewers Watch the Program? (N=50)*

	Interest in Program Topic	Love PBS	Convenient Airing Time	Friend/Family Member	Like Richard Alley
Number of Respondents	44	25	10	9	4

* Respondents could list more than one reason.

ETOM Television Program Impacts and Content Learned

As noted in the overall impacts, ETOM television program viewers were most likely to agree (3) or strongly agree (4) that the programs increased their topic interest and provided them with new information about climate change or sustainable energy (see Table 7). In fact, 82% of viewers (N=55) indicated that they had learned new information about climate change or sustainable energy alternatives from the programs. Viewers used this information to support beliefs they already held about climate change and potential solutions to the energy crisis.

Three topics from the programs stood out in terms of grabbing viewers' attention and providing valuable information: 1.) Evidence for human influence on the climate, 2.) how alternative energy solutions are used in different countries and in the United States, and 3.) military perspectives on climate change and alternative energies (see *Appendix E* for details). For example, the three Program One segments about human influence on climate change that viewers perceived to be new and most salient were: how carbon chemistry can be used to pinpoint human influence, how scientists gather information from ice cores, and the relationship between fluctuations in CO₂ levels and temperature. In addition, viewers were surprised by *"the degree to which the US military is concerned about climate change and the significant steps they are taking to become a greener organization."* Viewers also learned a lot about world energy demand and how sustainable energies could be cost-effective alternatives. The programs helped viewers see *"the great potential for all the renewables"* and identify possible solutions. In particular, some of the alternative energy initiatives that Program One focus group participants discussed more frequently included Brazil's use of sugar cane ethanol to power cars and support energy independence, as well as the history and the science behind solar power. Program Two focus group participants seemed surprised by how far behind the United States is compared to other countries in terms of its alternative energy policies.

Though respondents were less likely to report that the programs encouraged them to take action, to seek out resources, or to have discussions, they did identify ways the programs could facilitate those actions. Respondents specifically discussed using the programs as a *"tool to open family discussions on what we can do as individuals and on a broader spectrum, as a community to change our behaviors,"* and for classroom lessons.

Compared to other outcomes reported by viewers, the television programs had the least impact on changing viewers' perspectives on climate change. Since 95% of television program survey respondents were already "very" or "extremely" sure that climate change is happening, there was little room for change.

Table 7: ETOM Television Program Outcomes

Impact	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)	Number of Respondents	Mean*
Increased my interest in this topic.	0	1	23	21	45	3.44
Gave me new information about sustainable energy.	0	4	20	21	45	3.38
Gave me new information about climate change.	0	1	27	17	45	3.36
Makes me want to seek out further resources or information.	0	3	26	15	44	3.27
Encouraged me to have discussions about this topic with others.	0	7	21	17	45	3.22
Encouraged me to take action.	0	7	28	10	45	3.07
Changed my perspective on environmental issues.	2	19	17	6	44	2.61

* Survey respondents were asked to indicate their level of agreement regarding whether the television programs had impacted them in seven different areas, on a scale from 1 to 4 with 1 being “Strongly Disagree” and 4 being “Strongly Agree.” Respondents’ mean level of agreement is listed above. They could only give one rating per impact.

Viewers’ Opinions of ETOM Television Programs

Most viewers reported that they enjoyed the programs and felt that their expectations had been met (98%, N=42). One viewer described his expectations: *“From the reputation of the presenter and the producer, I was expecting an entertaining, thoughtful program that addressed the issues clearly and presented evidence-based information.”* The overall tone of the programs was seen as positive; *“This one leaves you feeling positive about things that can be done, when usually it is doom and gloom.”* Viewers thought that the programs were similar in quality to other shows on PBS, NOVA, and Discovery Channel. Yet viewers (93%, N=45) also felt that the programs presented information in a way that they had not seen on television before and offered *“a different perspective.”* They appreciated the programs’ detailed explanations of climate change concepts and that they offered viable solutions to the energy shortage problem:

“Instead of giving generalizations and, ‘Yes, there is global warming,’ this gives you the facts...Then it moves on to the next element of the program and it explains it and it gives the evidence, and it backs up what it is saying.”

Viewers (98%, N=42) also appreciated that the programs involved experts who presented information in a credible, yet understandable way. One viewer stated that the programs’ host had *“a knack for making really complex science sort of easy to understand and easy to relate to.”* Other viewers noted that the programs’ presentation of a series of arguments

followed by evidence was convincing (i.e., *“Tracing the evidence like a detective, from ‘bookkeeping’, double-checking facts, eliminating possibilities, etc.”*).

These viewers liked that the programs presented unexpected perspectives, such as Richard identifying himself as a Republican upfront and what the military is doing with sustainable resources: *“When the military is showing that it is pragmatic to be green and they are in the field using it, not just hippies with solar panels on their roofs, it lends a lot of credence.”* One participant talked about how the military energy use segment might appeal to new audiences:

“I was thinking about my parents – being conservative, former military... Without calling it constantly global warming... No it’s not going to be constantly warm everywhere but there are going to be changes. I think that it did a better job of explaining that with solutions without being better than you ‘I’m a scientist and you should know this’ attitude.”

Viewers appreciated the programs’ focus on specific stories and examples of how countries and communities in the United States are attempting to apply sustainable energy solutions. One such story, a segment on a Texas wind farm, was popular with viewers because it challenged their assumptions of the state and its inhabitants and told a relatable story. One viewer explained why this segment was memorable:

“I definitely think it brought it back to the theme of operators’ manual. It’s not just scientists and politicians and military men talking about this problem. It’s like farmers and the average people that are just [like] us, who got together and said this is what we need to do.”

In particular, viewers felt that it was important to show the financial side of alternative energy adoption, as a strategy that is a *“good way to convince people”*:

“I thought the combination of the science and a rural town and the profitability made it interesting. You don’t normally see economics and science and I think combining the two made it an interesting story instead of just on global warming or economics.”

Some focus group participants felt the programs were too one-sided towards the adoption of specific alternative energy solutions without giving more information about the drawbacks, costs, and challenges in implementing these alternatives¹. However, one challenge to energy adoption that resonated with viewers was the “Not In My Backyard” phenomenon because several viewers had personal experience combating infrastructure “eyesores” visible from their homes.

Several viewers mentioned that the television programs did not address what they could do as individuals, but instead, focused on what large corporations and countries are doing: *“We were among the operators, but they were not telling us what we should do—just big business and government.”* Although this is not covered in Programs One & Two, the website, Program Three and the ETOM Facebook page emphasize individual actions and

¹ Based on this focus group feedback, additional information weighing the pros and cons of different energy alternatives was added to the final version of Program 1.

ways to become involved; these resources became the places where the majority of such information resided.

Reactions to Program Host

Part of the success of the programs can be attributed to their unconventional host, Richard Alley (see Figure 5). While viewers trusted Richard's scientific professional expertise, they also appreciated his overall persona. Adjectives used to describe Richard's demeanor included earnest, "Indiana Jones like," "a Bill Nye kinda guy," "Woody Allenish," and "a little kooky." Viewers were surprised by Richard's political and religious affiliations, which he stated during Program One's introduction:

"[He] seems balanced, not irrational or shrill. Cautiously optimistic. He has the necessary education and experience to speak to the subject, but he doesn't come across as an isolated scientist out of touch with the needs of modern society."

Figure 5: ETOM Host, Richard Alley, On-site



ETOM Museum Outreach Event Findings

“We’ve all heard a ton about [the topic], so you’re a little bit leery going in that you’re going to get bored to death or hear the same things that you’ve heard time and time again, but [the speaker] was really good...I thought he was really clear and articulate in his descriptions and it was super easy to follow.”

Rockman et al collected information on the museum events from observations, surveys, and participant and partner interviews. The project supported data collection at twelve ETOM outreach events in four of the five museum locations: Oregon Museum of Science and Industry (OMSI – See Figure 6), Science Museum of Minnesota (SMM), the North Carolina Museum of the Natural Sciences (NCMNS), the Reuben H. Fleet Science Center in San Diego (Fleet), and the San Diego Science Festival². Attendees at each of the twelve events were approached by museum staff volunteers with paper surveys or asked to visit an online survey link. REA evaluators or museum staff also conducted interviews with attendees at five of the twelve museum events. 548 adult respondents answered at least one survey question about the ETOM museum outreach events; 57 adults participated in on-site interviews.

Figure 6: Photographs from the OMSI Science Pub (Indoor Image - Courtesy OMSI)



ETOM Museum Event Attendance

Approximate attendance numbers were obtained at a subset of museum outreach events by REA and museum staff observers and can be found in *Appendix I*. Survey respondents were asked to specify where they had attended an ETOM event. The largest number of survey responses came from the Science Museum of Minnesota (see Table 8). The Reuben H. Fleet Science Center had minimal survey responses and staff involvement, and difficulty recruiting participants to attend its events, in general.

² The Ft. Worth Museum of Science and History (FWMSH), did not have any museum events at which data was collected.

Table 8: Location of Museum Events Survey Respondents Attended (N=546)

	SMM	OMSI	NCMNS	Fleet	San Diego Science Festival
Number of Survey Respondents	210	140	121	56	19

Many attendees learned about the events via word of mouth (36%) or from an email, typically sent out to museum members to advertise the events (37%, see Table 9). Most went to an ETOM event due to an interest in the topic (81%) or a desire to see the featured speaker (27%, see Table 10). One event participant stated that she had attended an event because she wanted to be informed: “[My] son-in-law is a geologist and argues there [are] no climate changes, and I want to have good arguments.”

Table 9: How Did Viewers Hear About the Event? (N=537)*

	Word of Mouth	Email	Museum Website	Flyer/Signage Around Town	Social Media	Newspaper	Other**
Number of Respondents	194	199	63	38	21	15	127

* Respondents could list more than one method.

** The Other category includes 47 people who heard about the event as part of a university course syllabus, 28 people heard about the event from a teacher or professor, 6 people who heard about the event from a local PBS station, 16 were part of an environmental organization that was advertising the event, and 11 read about OMSI’s Science Pub on the McMenamin’s website, the location at which the event was held.

Table 10: Why Did Viewers Attend a Museum Event? (N=543)*

	Interest in Event Topic	Interest in Event Speaker	Friend/Family Member	Love of the Museum	Format of the Event	Other**
Number of Respondents	441	148	129	96	73	75

* Respondents could list more than one reason.

** The Other category includes 41 individuals who came to the museum for extra credit or a class.

Most respondents attended auditorium presentations with Richard Alley or went to a Science Cafe, which was a more intimate venue (see Table 11). As this information is self-reported, we believe based on location data that some respondents may have conflated lectures with Science Cafes or discussion forums.

Table 11: What Kinds of Events Did Participants Attend? (N=538)

	Lecture with Richard Alley	Science Cafe	Lecture by Other Presenter	Military Presentation	Outdoor Festival	Discussion Forum
Number of Respondents	215	191	61	49	20	3

ETOM Museum Outreach Event Impacts and Content Learned

The ETOM museum outreach events were most likely to encourage participants to have discussions with others, increase participants' topic interest and make them want to seek out new resources (see Table 12). The museum events, as with other ETOM resources, were least likely to change viewers' perspectives on climate change. Again, most attendees (69%, N=428), though fewer than the television programs, were very or extremely sure that climate change is happening; *"It seemed like a well-informed audience, people were talking to each other. You could tell they're all really tuned in already, so he was preaching to the choir."* Taken together, these findings indicate that although event attendees did not change their core beliefs about climate change, they felt empowered to share the information they learned with others. Scientists and non-professionals alike appreciated that the museum outreach events *"gave us language that we can use to communicate to other people, and I think that's what we need more than more data. We need to know how to frame the arguments. We need to know how to talk to people. How to address it, and I think that's what [the speaker] did."*

Table 12: ETOM Museum Outcomes

Impact	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)	Number of Respondents	Mean
Encouraged me to have discussions about this topic with others.	7	29	275	146	457	3.23
Increased my interest in this topic.	7	27	296	127	457	3.19
Makes me want to seek out further resources or information.	6	40	284	120	450	3.15
Gave me new information about climate change.	13	91	238	112	454	2.99
Gave me new information about sustainable energy.	13	99	253	87	452	2.92
Encouraged me to take action.	13	93	271	67	444	2.88
Changed my perspective on environmental issues.	39	254	116	34	443	2.33

* Survey respondents were asked to indicate their level of agreement regarding whether the museum events had impacted them in seven different areas, on a scale from 1 to 4 with 1 being "Strongly Disagree" and 4 being "Strongly Agree." Respondents' mean level of agreement is listed above. They could only give one rating per impact.

Museum outcomes differed significantly based on the location of the event (see Table 13). Specifically, event attendees at Fleet, OMSI, and SMM had significant increases in topic interest, learned significantly more about sustainable energy, felt significantly more encouraged to take action, and were significantly more likely to plan to have discussions with others than NCMNS attendees. The NCMNS results may have been tempered by severe

weather. OMSI event attendees were significantly more likely than all other event attendees to indicate that they had learned something new about climate change. SMM attendees were significantly more likely than NCMNS and Fleet attendees to learn something new about climate change. Some differences in impacts can be attributed to the varying focus of events in the different locations. There were no significant differences looking at paired comparisons, regarding changes in environmental perspectives.

Table 13: ETOM Museum Outcomes By Location**

Impact	Fleet Mean	San Diego Science Festival Mean	NCMNS Mean	OMSI Mean	SMM Mean	Number of Respondents	Significance Level
Encouraged me to have discussions about this topic with others.	3.38	3.12	3.00	3.30	3.28	457	.000*
Increased my interest in this topic.	3.35	3.18	2.97	3.27	3.22	457	.000*
Makes me want to seek out further resources or information.	3.31	3.12	2.93	3.17	3.22	450	.001*
Gave me new information about sustainable energy.	3.19	2.94	2.61	2.95	2.98	452	.000*
Encouraged me to take action.	2.98	2.94	2.61	2.98	2.95	444	.000*
Gave me new information about climate change.	2.71	2.65	2.63	3.38	3.08	454	.000*
Changed my perspective on environmental issues.	2.50	2.65	2.31	2.39	2.22	443	.030*

* Indicates a significant difference across museum sites at the .05 level, using a one-way ANOVA.

** Survey respondents were asked to indicate their level of agreement regarding whether the museum events had impacted them in seven different areas, on a scale from 1 to 4 with 1 being “Strongly Disagree” and 4 being “Strongly Agree.” Respondents’ mean level of agreement is listed above. They could only give one rating per impact.

Several outcomes differed significantly depending on the type of museum event one attended (see Table 14). Specifically, attendees of Science Cafes and Richard Alley lectures reported learning significantly more about climate change than attendees of military presentations and lectures by other presenters. This is not surprising, since the focus of the former two presentation types was intended to provide information on evidence for manmade climate change and examples of alternative energies that can be used to mitigate the issue, while the later presentations purposely focused on the feasibility of green energy. Participants who attended a “typical” Richard Alley lecture liked his enthusiasm for the topic and his use of analogies to illustrate complex concepts, such as the plumbing analogy used in one presentation. A participant explained, “[He] kept it in layman’s terms –*simplistic [sic]*, so that those of us who are not scientists could understand.” Specifically, several attendees talked about the relationship between CO₂ and climate change, and cited a graph presented by Richard as helping them understand this concept.

Table 14: ETOM Museum Outcomes By Event Type**

Impact	Outdoor Festival	Lecture with Richard Alley	Military Presentation	Science Cafe	Lecture by Other Presenter	Number of Respondents	Significance Level
Increased my interest in this topic.	3.17	3.23	3.36	3.10	3.11	451	.078
Makes me want to seek out further resources or information.	3.17	3.23	3.27	3.04	3.04	445	.028*
Encouraged me to have discussions about this topic with others.	3.17	3.28	3.38	3.18	3.04	451	.039*
Encouraged me to take action.	3.06	2.97	2.89	2.86	2.61	439	.010*
Gave me new information about sustainable energy.	2.78	2.99	3.31	2.73	2.85	447	.000*
Gave me new information about climate change.	2.72	3.10	2.62	3.11	2.75	449	.000*
Changed my perspective on environmental issues.	2.72	2.24	2.42	2.35	2.36	438	.080

* Indicates a significant difference across event types at the .05 level, using a one-way ANOVA.

** Survey respondents were asked to indicate their level of agreement regarding whether the museum events had impacted them in seven different areas, on a scale from 1 to 4 with 1 being “Strongly Disagree” and 4 being “Strongly Agree.” Respondents’ mean level of agreement is listed above. They could only give one rating per impact.

A few attendees who frequented Science Cafes felt that the ETOM speakers could have included more complex scientific data and explanation. However, most attendees seemed to appreciate the mere presence of “*real numbers and data.*” See *Appendix F* for details on specific concepts attendees learned as a result of their event participation.

Those who attended military presentations reported learning significantly more about sustainable energies (see Figure 7). The military presentations’ emphasis on sustainable energies likely contributed to this result. Those who attended Richard’s lectures also felt significantly more encouraged to take action than those who attended lectures by other presenters, perhaps because they were drawn in by Richard’s unique presentation style. There were no significant differences looking at paired comparisons, regarding changes in a desire to participate in discussions with others.

Figure 7: *The Military Goes Green Event Aboard the USS Midway in San Diego*



Attendees' Opinions of Museum Events

As with the television programs, the information provided in the museum events was seen as credible, apolitical, and trustworthy: *"His points were valid he backed them all up with many sources and experiences."* For the most part, event attendees (89%, N=457) felt that information had been presented to them in a novel way. One innovative presentation occurred at the San Diego Science Festival, where Richard sang a song about climate change. Attendees thought that this method was a straightforward way to present the content and enjoyed that children were encouraged to take part in the presentation on stage. The presentation had *"more of a light, fun tone, not the usual textbook type tone, but it had a lot of useful information, but in a fun, easily understandable way."* Attendees also liked events that contained a Q&A session, feeling that these were quality interactions that some liked more than the presentations themselves.

Lessons Learned From Museum Partnerships

ETOM's experiences coordinating events with several science museums provided several takeaways regarding the features of successful and unsuccessful partnerships. ETOM strategically partnered with museums with a vested interest in climate change education. One partner at the Fleet indicated that she had worked with ETOM to identify the types of events that made sense for them as an organization. *"We've sort of developed a reputation for being a place to go to find out about climate change...so this sort of builds on that and it builds on it very well."* For example, the Fleet scheduled several military events to discuss alternative energy because of San Diego's large audience of active and retired armed service members. Another perceived benefit to museums was the opportunity to reach out to audiences that may not typically visit the museum. However, in practice, this did not always pan out, as most attendees appeared to be frequent museum event attendees or members of the organization.

Museums appreciated having ETOM's help organizing potential speakers and topics of discussion, and saw opportunities to have access to speakers that they might normally have difficulty getting at their institution. For ETOM, benefits of the partnership included the ability to present ETOM's message in different formats, with custom content for each diverse location, opportunities for interactions between ETOM scientists and speakers and the public, and additional publicity for the television programs.

ETOM's partnerships with museums were moderately successful. The more successful partnerships, such as those with OMSI and SMM, had high levels of museum staff involvement and frequent communication with the ETOM project team. Less successful partnerships were often associated with staff turnover, especially at the leadership or point person level, or at places where staff responsibilities were distributed across too many departments. One partner explained, "*when there's so many different people involved and there's so many different locations ...so it's just making sure everyone's on the same page.*" For example, museum staff responsible for marketing the events were often different than those in charge of event logistics and from educators or leadership who might have the best conception of the events' overall objectives, as well as the initial contact with ETOM.

With advertising, in particular, some museums were initially unclear about who was in charge of ensuring adequate event attendance, despite this being clearly spelled out in the written agreements signed by both ETOM and the museums. Many museums sent out emails and posted information about the events via traditional methods such as their websites, emails to museum members, and signage in their museums leading up to the event. However, most museums had not developed strategies for reaching audiences outside of their traditional networks and did not successfully recruit the outside audiences that they had initially hoped to attract. Instead, these museum events often served loyal museum customers in providing valid arguments and data to back up manmade climate change.

Events that were incorporated into larger initiatives, like festivals, were more difficult to manage because they required coordination not only within the museum, but also with the organizers of those larger events. Single lectures or Science Cafes were much easier for both ETOM and the museums to schedule and execute successfully.

As a result of the difficulties encountered working with museums, ETOM reduced the number of museum events it was involved with in Year 3 and shifted focus to Facebook as a potential mechanism for reaching a wider audience.

ETOM Website Findings

"I truly see this as a rich and dynamic website. Thanks for it. I will bookmark it and use it to teach our young daughter about what we can do to help our earth."

REA collected website information through surveys, focus groups, web walkthroughs, and website analytics (see Figure 8). ETOM website users were recruited throughout the duration of the project to provide feedback on the website, both before and after its redesign, via surveys. Most respondents were directed to a website survey through a pop-up link or a link included on the ETOM homepage. Additional respondents answered questions about the website on surveys that focused mainly on the museum events, television programs, or the Facebook page. 713 survey respondents answered at least one question about the website. Of these, 52% responded to a survey before the website redesign and 48% responded after the website relaunched. The relaunch of the website focused primarily on changes to the look, feel, and navigation of the site. Feedback on website resources that remained relatively constant before and after the relaunch are included in the analysis.



Figure 8: Screen Capture from the Redesigned ETOM Website Homepage

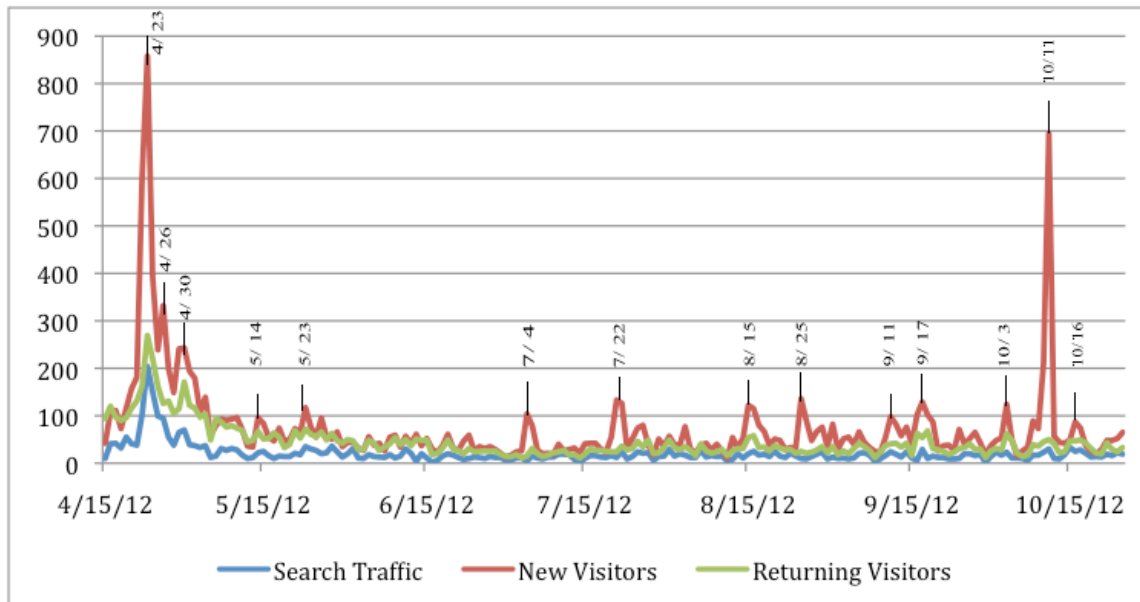
REA also held focus groups and conducted website walkthroughs in Philadelphia, PA and Bloomington, IN to gather information from a variety of people on the content and structure of the website before the redesign. Fifteen people participated in the website focus groups and five completed web walkthroughs. In addition, REA analyzed the data available from the *Earth: The Operators' Manual* website using Google Analytics tracking. This data shows trends over time in searches and web use in aggregate, since the website relaunch.

ETOM Website Use

The redesigned ETOM website has been seen by 14,866 unique users for a total of 23,168 visits. Most were new visitors (62%) but a large proportion of visits were returning visitors (38.1%). Most viewers came from the US (80%), but there were significant numbers from Canada (4.3%), South Korea (4%), and Australia (2.1%). Some other sites, with large numbers of views, came from locations highlighted in the television program.

Website use spiked around the original program airdate and again around October 11th (see Figure 9). Most trends in website use are mirrored throughout new visitors, returning visitors, and search traffic, with most traffic coming from new visitors.

Figure 9: ETOM Website Use Over Time



489 survey respondents were asked whether they had visited the ETOM website³. Of these, 12% indicated that they had gone on the ETOM website and were asked further questions about the program. Most survey participants reported learning about the website from another website link (23%), through social media (19%), or via the PBS website (17%, see Table 15). Overall, most viewers used a direct link to access the page (see Figure 10). Museum events and search engines were the least likely ways that survey participants found out about the website, though it is clear from the website analytics that many users did access the survey from a search engine. It may be that survey respondents were more engaged with the topics and less likely to stumble on the site with a general search. New visitors appeared to access the page more using Facebook, while returning visitors tended to do so with a direct link or via a Google search.

Website users indicated that they came to the website mainly due to interest in the topic (82%, see Table 16). Users were also likely to want to watch the television programs online (26%). A few respondents also indicated an interest in the site because they worked in energy or education fields and were looking for resources for use in public talks or classroom lectures; *“I have been teaching this stuff in college ...but I was looking for better ways to share them with broader audiences and I found that here.”*

³ This number excludes respondents who took the survey on the website itself.

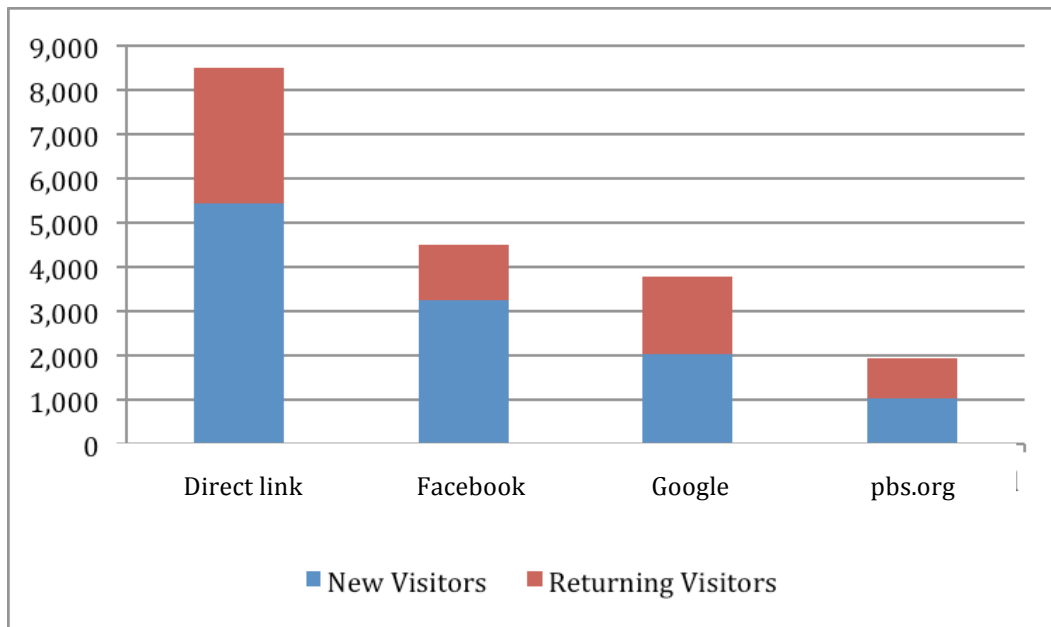
Table 15: How Did Users Hear About the Website? (N=220*)

	Other Website's Link	Social Media	PBS Website	ETOM TV Program	Email	Word of Mouth	Blog	Search Engine	Museum Event	Other**
Number of Respondents	50	41	37	33	29	29	18	13	6	28

*Respondents could list more than one method.

** The Other category includes 14 people who heard about the website from an environmental organization they were part of and 7 people who heard about the website at school.

Figure 10: Sources of Site Visitors



On the redesigned website, users reported that they mainly watched an ETOM episode or video clip, or looked at ETOM’s educational resources (see Table 17). Users were drawn to video clips and rich visual images on the homepage of the website, “*Because of its emotional impact and memorability.*” They felt that the videos were “*compelling*” due to their focus on personal stories and were of an appropriate length. Those who indicated that they would not watch any clips while on the website also reported rarely watching video from websites or thinking of them as a way to get information.

Respondents were less likely to say that they had interacted with ETOM on the website or used the widgets on the page. It is likely that website users commented on interacting on the website less because they interacted more naturally in dialogue with others on the ETOM Facebook page.

Table 16: Why Did Users Go to the Website? (N=206)*

	Interest in Website Topics	Wanted to Watch Programs Online	Saw TV Program	Looking for Educational Resources	Recommended By Others	Like Richard Alley	Attended Museum Event	Other**
Number of Respondents	169	54	42	41	37	35	9	19

*Respondents could list more than one reason.

**The other category includes 7 people who visited the site for professional reasons, 3 people who wanted to find resources to share with others, and 3 who wanted to download materials from the site.

Table 17: Self-Reported Sections Visited on the Redesigned Website

Website Action	Number of Respondents (N=104)	%
Watched an entire episode of the program	40	38%
Gathered educational resources	31	30%
Watched a video clip from one of the broadcasts	27	26%
Watched one of the web-only videos (OSTRICH, HERO, COMMUNITY, etc.)	23	22%
Calculated my energy usage	15	14%
Used one of the widgets	8	8%
Asked ETOM a question	4	4%
Nominated a hero or an operator	1	1%
Other	21	20%

The webpage analytics show that most people visited the homepage. After landing on the homepage, viewers most often sought out video in the *Watch and Share* section. Users, in general, appreciated “*the ability to watch the show*” on the website itself and share the program and program clips with others. All three programs appear in the top 10 most viewed pages, in addition to the *Watch and Share* homepage. On the video pages, visitors spent a mean time of 2:11 minutes, with the longest views of *Earth: The Operators’ Manual* (Program One) and the shortest views of *Energy Quest USA* (Program Three). Website visitors spent the most time on the *Calculate Your Energy Use* page and the least time on the *Watch & Share* landing page, although interestingly this page also had the lowest percentage of people exit the site there at 18% (See Table 18). This likely shows that users continued from the *Watch and Share* landing page to watch the videos. Users in the website walkthroughs were also observed being visually engaged with the quizzes on the website. One retired teacher indicated that such quizzes would be perfect for students because the answers appear immediately and would work both before a lesson and after to reinforce it.

It is clear that many viewers were directed to the website from social media outlets, overwhelmingly from Facebook; but those viewers also had the shortest visit duration. Facebook users most often engaged with the *Calculate Your Energy* page on the website. ETOM dedicated numerous Facebook posts to promoting this feature, so these efforts seem to have paid off. Most Facebook users exited the site from this page (95%) or if directed there, from the homepage (59%), but those that continued to stay on the site generally navigated to the *Watch and Share* page and went on to watch *Earth: The Operators' Manual*. This pattern of use illustrates how some participants had an integrated ETOM experience, using Facebook as an entry point, the ETOM website as a middle point, and finishing their ETOM exploration with one of the programs. Such exposure to multiple ETOM media was one of the goals of the project, and it appears that at least in some instances, it was achieved. People that came to the website from Twitter spent the most time (4:59) and viewed the most pages (3.38 pages), on average (see Table 19).

Table 18: Website Sections Visited by Page, Including Page Views, Mean Time on Page and Exit Percentage

Page	Page Views	Mean Time on Page	% Exit
Home	12,529	0:01:27	40.69%
Watch & Share - Landing	8,178	0:00:40	17.99%
Watch & Share - " <i>Earth: The Operators Manual</i> "	5,896	0:02:22	59.33%
Don't Wait Do Something Now - Calculate Your Energy Use	3,330	0:03:18	80.90%
Watch & Share - " <i>Powering the Planet</i> "	1,809	0:01:54	48.65%
About the Program	1,731	0:01:36	35.30%
Energize Your Community - Communities Taking Control	1,450	0:03:55	62.21%
For Educators	1,425	0:01:11	34.95%
Watch & Share - " <i>Energy Quest USA</i> "	1,403	0:02:14	49.54%
Don't Wait Do Something Now - Getting Started	1,085	0:00:53	24.06%

Table 19: Social Network Visitors

Social Network	Visits	Avg. Visit Duration	Pages / Visit
Facebook	4,489	0:01:11	1.62
Twitter	105	0:04:59	3.38
LinkedIn	29	0:02:07	2.72
WordPress	28	0:03:16	2.64

Users of the redesigned website were asked to indicate how else they interacted with ETOM materials. Many had also "Liked" ETOM on Facebook or shared ETOM information online (see Table 20). The most common way to share ETOM info online was via Facebook (see Table 21). Some website users indicated that they had emailed links to the website or specific information found on the website to friends and family members.

Some viewers discussed using the website videos, either clips or entire programs, to reach “skeptics.” The “How to Talk to an Ostrich” videos, in particular, were seen as “superb and are full of little nuggets that are new to me and probably most audiences,” and “short enough that I can ask some fence-sitters to watch.” As with the television programs and social media, users were finding ways to extend ETOM’s audience beyond those who already believed in manmade climate change to include skeptics. These users saw the ETOM website as integral to the task of gathering resources for future discussions. The ETOM website was an effective tool for individuals who were looking to build arguments using evidence because the website “presented information in a short, succinct manner that nicely debunks the deniers’ favorite talking points.”

Table 20: Other Ways Website Users Interacted with ETOM*

	I Liked ETOM on Facebook	I shared ETOM info online	I went to an ETOM event	I followed ETOM on Twitter	Other
Number of Respondents (N=67)	48%	28%	13%	9%	16%

*Some respondents listed more than one method of interaction.

Table 21: Locations for Sharing*

	On Facebook	On discussion boards	On Twitter	On my blog	On someone else’s blog	Other
Number of Respondents (N=18)	61%	22%	18%	6%	0%	39%

*Some respondents listed more than one location.

ETOM Website Impacts and Content Learned

The ETOM website, in both its iterations, was likely to encourage users to have discussions with others and instill a desire to seek out more resources on relevant topics (see Table 22.) In fact, many said they would return to the ETOM website itself when they wanted to do research or had questions on relevant information. When asked, website users were not as likely to report that the site had provided them with new information, although on specific questions, 78% (N=244) felt that the website presented new information about climate change and/or sustainable energy that they had not known before. These differing results could be due to the wording of the questions, as well as the sample size for each question.

Users said that they enjoyed seeing how sustainable alternatives are being implemented around the world: “They give real examples of how people are coming up with practical solutions that can make a big difference.” They tended to gravitate towards energy narratives about countries that were of personal interest to them.

Users were less apt to find out about ways to get involved at a community or national level from the website. Again, due to the percentage of users already certain of climate change (93%), the website was least likely to change users’ perspectives on environmental issues.

Table 22: Overall Impacts of Website on Users

Impact	Strongly Disagree (1)	Disagree (2)	Agree (3)	Strongly Agree (4)	Number of Respondents	Mean*
Encouraged me to have discussions about this topic with others.	1	6	59	70	136	3.46
Makes me want to seek out further resources or information.	2	10	63	61	136	3.35
Encouraged me to take action.	2	13	71	50	136	3.24
Increased my interest in this topic.	1	9	79	37	126	3.21
Gave me new information about sustainable energy.	3	15	77	30	125	3.07
Get involved with environmental initiatives in my community or at a national level.	4	11	21	23	59	3.07
Gave me new information about climate change.	1	23	68	33	125	3.06
Changed my perspective on environmental issues.	16	62	36	11	125	2.34

*Survey respondents were asked to indicate their level of agreement regarding whether the museum events had impacted them in seven different areas, on a scale from 1 to 4 with 1 being “Strongly Disagree” and 4 being “Strongly Agree.” Respondents’ mean level of agreement is listed above. They could only give one rating per impact.

There were a few notable differences between the impact of the redesigned website and the that of the old website (see Table 23.) The redesigned website was significantly more effective in providing users with new information about climate change. The redesigned website was also significantly better at providing users with new information about sustainable energy solutions. Finally, users of the redesigned website felt significantly more encouraged to take actions to reduce their energy consumption than those who used the older version of the website.

When users described what they had learned from the website, they tended to talk about new examples of sustainable energy solutions, facts about CO₂ levels, and about calculating their own energy use. A few respondents also talked about military adoption of alternative energies (see *Appendix G* for details regarding specific content learned.)

Table 23: Specific Impacts of Website Versions**

Impact	ETOM Website Mean Before Redesign	Number of Respondents Before Redesign	ETOM Website Mean After Redesign	Number of Respondents After Redesign	Significance Level
Encouraged me to have discussions about this topic with others.	3.38	77	3.56	59	.088
Makes me want to seek out further resources or information.	3.31	77	3.39	59	.510
Increased my interest in this topic.	3.25	79	3.13	47	.256
Gave me new information about climate change.	3.17	78	3.89	47	.032*
Gave me new information about sustainable energy.	3.17	78	2.91	47	.043*
Encouraged me to take action.	3.08	78	3.47	58	.001*
Changed my perspective on environmental issues.	2.38	78	2.26	47	.391

*Indicates a significant difference between the website before the redesign and the website after the redesign at the .05 level, using an independent samples t-test.

**Survey respondents were asked to indicate their level of agreement regarding whether the museum events had impacted them in seven different areas, on a scale from 1 to 4 with 1 being “Strongly Disagree” and 4 being “Strongly Agree.” Respondents’ mean level of agreement is listed above. They could only give one rating per impact.

Overall Reactions to the ETOM Website

Users thought that the website was clean, clear, and useful, and appreciated its *“quality and breadth.”* Some noted that the website was *“more comprehensive”* than the television programs, but a few felt that the website appeared *“in service”* of the show. Comparing the ETOM website to other sites, one participant said, *“It held my interest. This is something in this day and age!!!”*

Overall, users commented that they felt the website was reliable and trustworthy. Users expressed surprise at some of the facts on the website and were interested in the new information and the novel way it was presented (86%, N=126), yet they were also able to find what they were looking for on the site (88%, N=75).

ETOM Facebook Findings

“Two of my friends are there because of my sharing [the Facebook page]. This small rolling snowball can roll into an avalanche.... at least until it melts.”

Earth: The Operators' Manual initially launched its Facebook page on March 9, 2011. A revamped version of the page appeared in conjunction with the airing of the two new ETOM television programs and the project's website relaunch on April 16, 2012 (see Figure 11).



Figure 11: Screen Capture from the Redesigned ETOM Facebook Page

REA evaluators explored the impact of the Facebook page on its users through focus groups, post coding, and examining metrics from the page. REA examined how users were engaging with and finding out new information from the page by conducting a series of focus groups with visitors to the page. REA also coded Facebook post content and ran analysis on Facebook page metrics, both starting at the relaunch date.

Facebook Page Metrics

REA analyzed the metrics available from Facebook on the ETOM Facebook page⁴. These metrics covered most steps that users can take to interact with content on Facebook. Users can “Like” the page, which can be done once, as well as Like individual posts, which can be done separately for each entry. There are also metrics for how often the page or an individual post is viewed. Organic views are users that saw the original post on the ETOM Facebook page. Viral views are users that saw the post in a story created by a friend, not the original ETOM post. There is some variation between the metrics for post views and daily interaction with the page, which are described below.

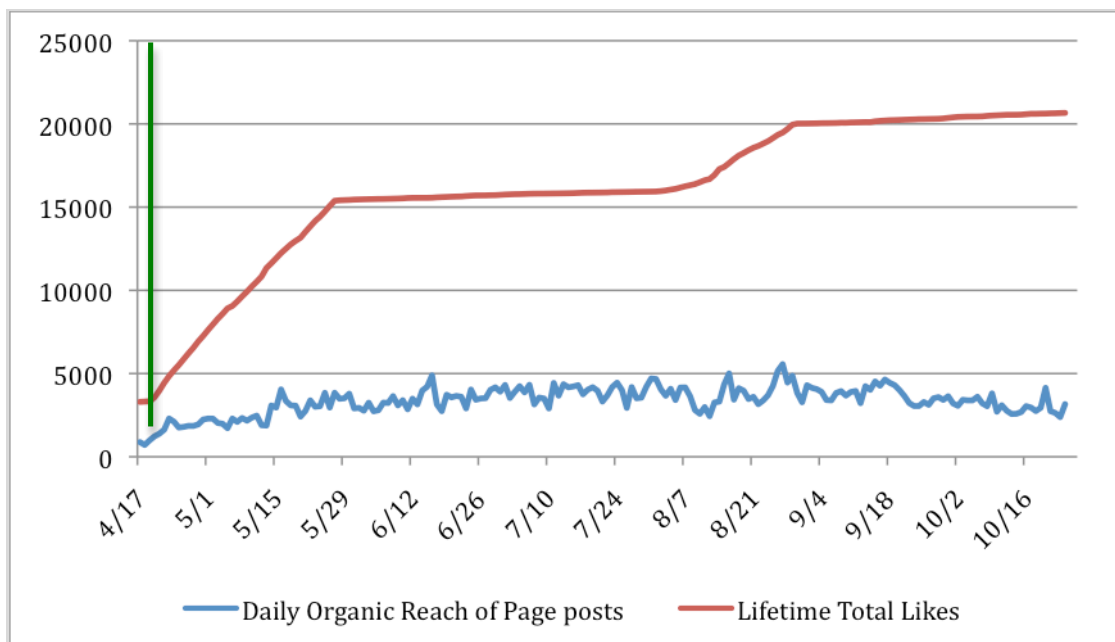
⁴ All statistics provided by Facebook represent a snapshot of the user experience at a particular point in time. In the future, Facebook may change its algorithms and formulas to calculate analytics. Current definitions of the types of data Facebook gathers are provided throughout this section of the report.

Throughout the examined period, April 15th – October 25th, ETOM posted approximately 3-4 stories per day. During the final full week in October, each post was viewed by approximately 2,000 unique users⁵.

The *Earth the Operators' Manual* Facebook page had approximately 20,700 Facebook users who have Liked the page as of October 28, 2012⁶. Facebook Help describes a Like as “making a connection” and that a Like “is an easy way to let someone know you enjoy it [a post].” Information from Facebook’s page data shows there was a steady increase in Likes for a month following the programs’ April 22 airdate, then a leveling period, followed by another increase in the second half of August and another leveling period through the end of October (represented as the red line in Figure 12).

In the analysis of the page over time, REA focused on Organic Reach of Page Posts, which is defined as “daily unique users: the number of people who visited your page, or saw your page or one of its posts in News Feed or ticker.” Figure 12 shows the reach of the page over time, including a green line representing the television shows’ initial airdate, April 22. The page is currently reaching between 2,000 and 5,000 unique users daily (represented as the blue line).

Figure 12: Page Organic Daily Reach and Lifetime Likes

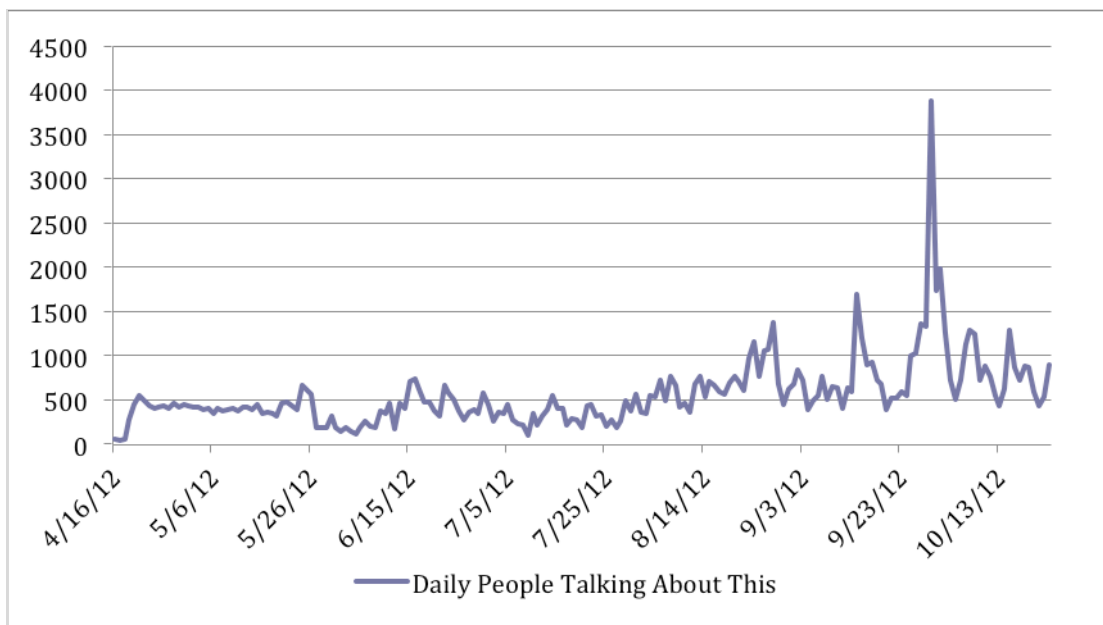


⁵ In some weeks, Facebook’s built-in analytics showed more than 400,000 “People Reached.”

⁶ The *Earth the Operators' Manual* Facebook page had 26,573 Facebook users who have “Liked” the page as of January 22, 2013.

Other important factors in the timeline analysis were daily new Likes and people “Talking About This” [page]. People talking about this [page] is defined as “*unique users daily: the number of people sharing stories about your page. These stories include Liking your page, posting to your page's Wall, Liking, Commenting on or Sharing one of your page posts, answering a question you posted, RSVPing to one of your events, mentioning your page, or photo-tagging your page.*”⁷ As shown in Figure 13, the largest number of people Talking About This [page] on Facebook during the observed time period came on September 29th. This is most likely due to two posts discussing California energy bills (Sept. 28th) and California solar farm construction, which were both very popular in themselves; both were in the top 5 most talked about ETOM posts.

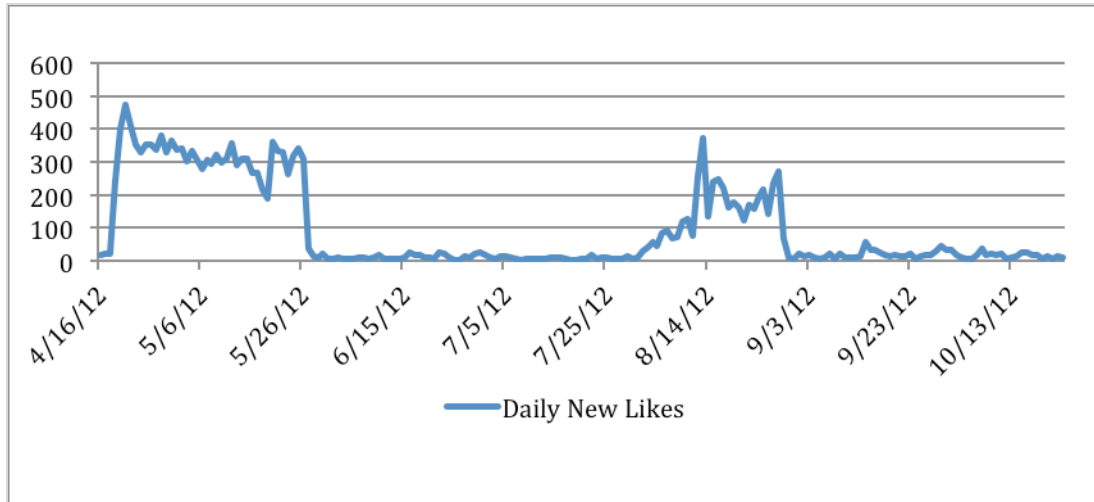
Figure 13: Daily People Talking About This



Comparing Figure 13 and Figure 14 you can see that the Daily New Likes very closely mirrors the daily people Talking About This [page], though on a different scale. One major difference is that during the initial phase of the relaunch there were significantly more new Likes and the new Likes were near the same levels as the people Talking About This [page], which is to be expected, based on the television airdates and the page gathering Likes from the original audience of those interested in climate change and alternative energy. The second spike in new Likes in mid-August to early September does not seem to be attributable to other Facebook activities or re-airings of the television program around the same time period.

⁷ As of January 22, 2013, there were 6,099 people Talking About This [ETOM Facebook page].

Figure 14: Daily New Likes



Some ETOM Facebook posts seemed to gather Likes, views, and Shares on a different level than the rest of the posts or page. In analyzing those posts, REA gathered the 10 posts with the highest organic reach, which was utilized above and is described as “*daily unique users: who saw the post in a newsfeed, ticker, or the page.*” REA used these posts to compare where they fell among all ETOM posts for the most talked about, highest viral reach and total reach from April 16th to October 25th. REA identified the 100 most talked about posts, defined as *over the post’s lifetime, the number of unique people who created a story about this page post.* REA also examined the top 100 posts with the highest viral reach, “*over the post’s lifetime the number of people who saw your page post in a story from a friend and the post’s total reach, lifetime number of people who saw the post including advertised and sponsored posts.*”

There are some interesting patterns in the data (see Table 24). One example, highlighted in blue below is an ETOM *Tip of the Day*, which had the 3rd highest organic reach, 2nd highest people talking about this page and post viral reach, but has only the 75th highest total reach. In a situation like this, the post was reposted or used to create a story often, which in turn means that users see the repost or created story and the viral reach is higher, but that did not seem to affect the total reach of the post in comparison to the reach of other ETOM posts.

Table 24: Post Placement of the Top 10 Organic Reach Posts in the Top 100 Posts for Talking About This, Viral Reach, and Total Reach

Post Content	Lifetime Post Total Reach		Lifetime Post Viral Reach		Lifetime Talking About This (Post)	
	Ranking Out of 100	Raw #	Ranking Out of 100	Raw #	Ranking Out of 100	Raw #
1. Richard Muller, lead scientist in the Koch-funded BEST climate study says global warming is real, and "Humans are almost entirely the cause." 7/29/2012	71	9,894	1	5,047	14	792
2. 77 percent of Americans now believe the government should limit the amount of carbon dioxide that businesses can emit. 8/26/12	32	22,910	7	1,368	24	625
3. ETOM TIP OF THE DAY: Green your daily lunch routine. Keep some real silverware at the office. 6/15/12	75	5,919	2	2,151	2	2,652
4. ETOM Tip of the Day: Opt out of junk mail. Not only is it annoying, but it consumes 100 million trees per year in the US alone. 9/12/12	81	4,162	69	474	29	555
5. Yesterday, for the first time in US history, clean, renewable ocean energy flowed into the electric grid. 9/14/12	82	4,132	64	480	5	1,629
6. "...the average temperature of the earth's land has risen by two and a half degrees Fahrenheit over the past 250 years." 7/31/12	83	4,061	93	413	N/A*	239
7. The West on fire. 6/30/12	77	4,761	13	1,138	36	445
8. One man's trash is another man's fuel. Fulcrum's Sierra BioFuels Plant may produce as much as 10 million gallons of ethanol a year. 8/25/2012	65	12,148	99	401	69	305
9. Our second program, POWERING THE PLANET, is back on many PBS stations this evening, Wednesday August 15th, at 10pm. 8/15/12	22	27,412	60	522	N/A*	210
10. Boosting the use of combined heat and power (CHP) to 20% of the generating capacity of the U.S. by 2030 would save 5.3 quadrillion thermal units. 8/31/12	87	3,801	N/A*	278	35	449

*N/A = Post had a ranking higher than 100.

Most users who provided feedback indicated that they would click Like "if the post strikes me," but rarely Commented on a post. Users indicated that they were more likely to Comment on a post if someone had a viewpoint that they disagreed with, if the post contained inaccurate information, or if they had personal experience with the topic that they wanted to share:

"If it's something I can contribute information to, then I'm more likely to post and Share. Example - today I replied to a post about compost. I think a lot of the individual actions that people can take are a good way to get people to post - particularly if it is something that they've done at home or that they can Share with others."

Facebook Post Coding

REA coded 416 posts made on ETOM’s Facebook page from April 16, 2012 - September 7, 2012 using four different categories: Post Title, Post Topic, ETOM Mentions, and Political Mentions. Post Titles referred to specific ETOM features, such as the ETOM Tip of the Day, as well as promotional posts. Post topics were coded for the presence of facts versus editorials and for Climate Change, Alternative Energy, or Energy Use, as well as for promotional use (see *Appendix H* for coding scheme).

ETOM Posts By Title

Most of the examined posts were not categorized, meaning that they were not given a title by ETOM and were coded as General posts (see Table 25). A moderate number of posts directly promoted Richard Alley, the ETOM website, the television programs, or events. When comparing the four types of posts that were given a title by ETOM, the ETOM Tips of the Day were posted more frequently than other types of posts, but this difference was not significant.

Table 25: Facebook Posts By Title

Topic	Number of Posts	Percentage of Posts
General	251	60%
Self-Promotion	54	13%
ETOM Tip of the Day	48	12%
ETOM Quote of the Day	26	6%
Earth Operator of the Week/Energy Hero	19	5%
Talk to An Ostrich	18	4%

ETOM Tips of the Day received the most number of Likes on average, perhaps because Facebook users enjoyed reading information about *“the kinds of actions others are taking, and, therefore, ones that are viable and practically achievable for me, too,”* much like television viewers and museum attendees requested (see Table 26.) General posts and ETOM Quotes of the Day averaged the most Shares and Comments, which could be due to the fact that General posts tended to contain a lot of data figures and new information for people to respond to, while quotes could be provocative and used to begin a dialogue with others, which was one of the reasons that users came to the Facebook page.

Self-Promotion posts received the least number of Likes, Shares, and Comments, on average. This makes sense since these posts were about providing details about when and where to watch the show, described events at which Richard was presenting or had presented, or encouraged Facebook users to go to the website, whereas the other types of posts contained specific climate change or sustainable energy content. The strategy to direct Facebook users to the website, seemed effective given that the majority of social media traffic came from Facebook. Energy Operator of the Week posts also had a low number of average Comments, perhaps because the focus was mainly on praising a

particular person for their environmental efforts rather than on specific facts or tips an everyday person could use. There were no significant differences between the four ETOM-titled posts with regards to the number of Likes, Shares, or Comments.

Table 26: Average Number of Likes, Shares, and Comments By Post Title (N=414)

Topic	Likes	Shares	Comments
ETOM Tip of the Day	135.96	32.77	21.71
ETOM Quote of the Day	119.62	41.15	14.50
General	105.47	43.54	17.53
Talk to An Ostrich	79.22	36.83	11.89
Energy Operator of the Week/Hero	79.21	23.05	7.37
Self-Promotion	30.91	11.98	3.24

ETOM Posts By Topics

Most posts were Climate Change, Energy Use, or Alternative Energy Editorials (see Table 27). These posts could contain some factual information, but had someone’s opinion or perspective interpreting the information. The focus of the ETOM Facebook posts, as in the television programs, was mainly on providing compelling climate change perspectives and examples of implementations of sustainable energy alternatives. However, one thing that television viewers had lacked in Programs One & Two was information on what they could do at home to monitor and reduce their energy use. The Facebook page filled this need by presenting a number of posts in this area.

Table 27: Facebook Posts By Topic

Topic	Number of Posts	Percentage of Posts
Climate Change Editorial	106	26%
Energy Use Editorial	85	20%
Alternative Energy Editorial	73	18%
Climate Change Fact	45	11%
Self Promotion	43	10%
Energy Use Fact	34	8%
Alternative Energy Fact	30	7%

Alternative Energy Facts received the most number of Likes, on average (see Table 28), which is not surprising given that television viewers, museum attendees and website visitors also indicated that examples of countries and communities utilizing sustainable energy was one of their favorite topics covered by ETOM. Climate Change Editorials had a lower number of Likes, compared to the other five topics. Alternative Energy Facts and Climate Change Facts received the most Shares and Comments, on average; one user mentioned sending an ETOM link on natural greenhouse gases to a colleague as part of a discussion of natural vs. manmade CO₂. Energy Use Facts and Editorials had the least

number of Shares, perhaps because these posts often focused on the individual user, inviting them to calculate their own energy use, which they would do as opposed to sharing on Facebook, or providing suggestions that they incorporate into their own daily lives to reduce their energy consumption. Topics that contained editorials had the least number of Comments, which might have had something to do with the nature of editorials, which already contained an opinion, while fact-based posts invited additional perspectives because they had not yet been interpreted. As before, Self-Promotion posts had the least, number of Likes, Shares, and Comments. There were no significant differences between the six types of topics with regards to the number of Likes, Shares, or Comments⁸.

Table 28: Average Number of Likes, Shares, and Comments By Post Topic

Topic	Likes	Shares	Comments
Alternative Energy Fact	153.40	52.50	22.00
Alternative Energy Editorial	124.10	42.67	15.97
Energy Use Fact	121.74	27.53	17.09
Energy Use Editorial	92.77	30.30	14.40
Climate Change Fact	92.69	48.44	20.11
Climate Change Editorial	86.38	40.61	15.76
Self Promotion	38.67	14.37	3.16

Forty-two percent of the examined posts mentioned ETOM or linked to an ETOM resource such as a YouTube video or the ETOM website. Posts that specifically mentioned an ETOM resource had significantly fewer Shares and Comments than other posts (see Table 29.) There are several potential reasons why the Shares and Comments on posts with ETOM resources were significantly lower than other types of posts. First, many of these posts directed users away from the Facebook page, to the ETOM website or to YouTube videos which also contain a Commenting feature. Once users became engaged with these resources, they may not have seen a need to return to and Comment on the original post. In addition, several posts encouraged actions rather than feedback, such as watching an ETOM television program, taking a quiz, or hosting a watch party. Finally, a few posts were frequently reposted by ETOM, and users likely did not feel the need to Comment on or Share information that they had already utilized.

Eleven percent of the posts mentioned politics. Posts that referenced politics had fewer Likes, Shares, and Comments than other posts, but these differences were not significant (see Table 30). This trend makes sense since most website users, and ETOM participants in general, felt that ETOM is apolitical and appreciated its neutral stance.

⁸ Self Promotion posts were not included in the statistical analysis because they have a different purpose than the other kinds of topical posts.

Table 29: Average Number of Likes, Shares, and Comments By ETOM Mention

Topic	Likes	Shares	Comments
No ETOM Mention/Link	107.20	43.62	18.09
Mentioned ETOM or Linked To ETOM Resource	84.75	27.29	11.29
Significance level	NS*	.000	.006

*NS = Not significant

Table 30: Average Number of Likes, Shares, and Comments By Politics Mention

Topic	Likes	Shares	Comments
No Mention of Politics	99.92	37.76	15.74
Mentioned Politics	81.00	29.04	11.28
Significance level	NS	NS	NS

ETOM Focus Group Findings

ETOM posted several invites on its Facebook page to generate user interest in providing feedback, and REA reached out to several Facebook page users via individual message. REA attempted to reach out to both those who are skeptical about climate change and those who believe climate change is happening, but skeptics who posted on the ETOM Facebook page did not appear interested enough to participate in the focus groups.

Focus groups, were conducted synchronously and lasted approximately one hour; the interaction occurred in an online chat format in which a moderator asked a series of scripted questions as well as follow-up queries based on participants' responses (see *Appendix D* for protocol.) Some respondents, who could not attend a live chat, participated via email or a discussion board.

In total, twenty-three Facebook users provided feedback on the ETOM Facebook page. Of these, ten were male and seven were female, and six did not specify their gender. Participants ranged in age from their 30s to their 60s.

Attraction of ETOM's Facebook Page

Users found out about the Facebook page in quite different ways. Most users (70%, N=23) found out about the ETOM Facebook page from friends, online links and other social media, and by searching for ETOM-related topics. People also found out about the ETOM Facebook page through one of the ETOM television programs, website, or presentations (39%), which supports other data on the overlap between ETOM resources.

Overall Reactions to the ETOM Facebook Page

Users liked that the Facebook page *"is factual, has been vetted and is also politically neutral"* (see Table 31.) One participant explained: *"ETOM has stayed above the dirty by citing DATA."* Another elaborated, *"It is solidly solution-oriented. Here are the data. This is the problem. It (sp) are some of the most effective solutions... The objectivity is a nice change from much of the fact-lite whininess [on other pages]."* As with other ETOM media, users

appreciated the page was positive.

Users noted that information from a credible source is *“harder to refute”* and *“gets people to pay attention.”*:

“I like it because I am confident the information is accurate [and] is presented in a way that appeals to the values of the general public to inspire action...[Richard Alley and other scientists are] great messengers for the climate change action. The way the information is accessible to all people appeals to me. It is quick, truthful and to the point.”

Users liked the page’s rich visuals and videos *“that catch your eye and can be used to help in discussions,”* in particular those that provided a point of comparison or examples of effective solutions *“as we like to be competitive.”* One participant summed up the page by saying, *“Great graphics, great videos, original stories that haven’t been overexposed online already.”*

Table 31: Aspects of the Facebook Page Users Liked (N=23)*

Aspect	Number of Respondents Who Mentioned
Facts/News	6
Videos	5
Rich Visuals	4
How To Talk To An Ostrich	3
Tips of the Day	3
Energy Topics	2
Green Quiz	2
Calls To Action	2
Military Topics	1
Facebook “Share” feature	1
Climate Topics	1
Science Focus	1

* Some users listed more than one aspect of the page.

In terms of specific types of posts, users seemed to enjoy the *How to Talk to An Ostrich* segments, which were linked from Facebook to ETOM’s YouTube page. One user highlighted the video clips as *“hands-down the most effective climate communication clips out there,”* while another user placed links to those videos on his own climate-focused website.

Topics on the page that stood out to users as particularly memorable included the projected energy demand and manmade environmental impacts such as deforestation and

oil spills. Users indicated that these areas had stood out due to personal interest. Several users indicated that they liked hearing about sustainable energy alternatives:

"I like when innovation and ingenuity posts are made as those really get people thinking in different ways about what is possible. Like the post about burning trash as an energy source or that 78% of businesses now have climate in their plans."

In fact, one participant felt that ETOM did a better job at covering *"the technologies being innovated to help reduce climate change"* than other environmentally-focused groups.

Website vs. Facebook

Most participants seemed to prefer the ETOM Facebook page to the website. They liked the Facebook page because it is easily accessible when they log on to Facebook, convenient, and it is a *"central source for interests."* In addition, users appreciated that the information presented on the page was clearly explained and up-to-date. Several people found the ETOM Facebook page to be the best way *"to stay on top of environmental issues."* One participant explained, *"I also like the premise that there is on-going investigating that is happening by you folks, and that will be posted to the page. It seems that, more than ever, I seek news content based on links posted to FB."* It was also important that Facebook is formatted for their mobile devices and that it is *"designed for browsing."*

Impacts of the Facebook Page

A small sample of users (N=6) indicated that the Facebook page was slightly more likely to encourage them to take personal actions to reduce their energy consumption (see Table 32):

"[The] ETOM Facebook page does give me information on kinds of individual, community, or national actions I can take, from simple meatless Mondays to informing me about municipal solid waste plants generating electricity from burning trash."

The page was least likely to encourage them to get involved with environmental initiatives, possibly because participants were *"already involved in climate change education before Liking ETOM."* However, participants still felt that the page outlined information about ways to get involved in green initiatives and activities.

A few participants felt that the Facebook page provided a place for people with similar interests to congregate. Some felt the page supported their beliefs: *"I like that other people agree that we need to change our ways a little. Recycle more, and not drive as much to help our environment."* However, it should be noted that skeptics likely posted to the page to incite reactions and engage in debate, rather than to find others like themselves.

Table 32: Impacts of the ETOM Facebook Page (N=6)

Impact	Not At All Likely (1)	Somewhat Likely (2)	Likely (3)	Very Likely (4)	Mean
Take personal action to reduce my energy consumption.	0	0	1	5	3.83
Seek out further information or resources on the topic.	0	0	2	4	3.67
Have discussions about this topic with others in person or online.	0	0	2	4	3.67
Get involved with environmental initiatives in my community or at a national level.	0	0	4	2	3.33

* Survey respondents were asked to indicate their level of agreement regarding whether the Facebook page had impacted them in seven different areas, on a scale from 1 to 4 with 1 being “Strongly Disagree” and 4 being “Strongly Agree.” Respondents’ mean level of agreement is listed above. They could only give one rating per impact.

Several Facebook page users, as with other kinds of ETOM media, indicated that they used or planned to use information from the Facebook page during online or in-person discussions with friends or family members, particularly those who might be more skeptical of manmade climate change. One participant mentioned starting such conversations: *“I reference the links all the time in on-line discussion with my friends...They then react to the posts.”*

Some Facebook users incorporated ETOM resources and concepts into courses they taught at high schools and colleges. Teachers also reported sharing ETOM resources professionally; one teacher mentioned, *“I often Share ETOM posts on my Educational FB pages for teachers.”* Individuals also mentioned reposting ETOM resources on other environmentally-focused websites.

Conclusion

"I feel this needs to be seen by everyone. The way information is presented is not like anything I have seen before. It's very, 'Here are the facts. We can either change our ways, or not. But the earth will go on with or without us.'"

ETOM was successful in its mission to create a set of media resources and activities that explain climate change issues and sustainable energy alternatives in an apolitical, clear and compelling way. The project's main audience tended to be those who already think that climate change is happening and are taking steps to reduce their energy consumption, which according to national statistics, represents 70% of the population (Leiserowitz, Maibach, Roser-Renouf, & Hmielowski, 2012). However, ETOM's message was able to reach a secondary audience of skeptics through those same viewers and visitors who felt empowered to share ETOM information with others. In fact, ETOM's media was seen as an integral source for gathering credible, fact-based evidence to use in future discussions and debates. In this way, ETOM's initial reach was expanded by its base of interested and galvanized individuals to reach out to others who did not yet hold the same beliefs. ETOM's initial reach was expanded as audiences shared resources and information with less engaged and unconvinced individuals.

ETOM media also met several important project objectives. Participants who engaged with ETOM resources learned new information about climate change and sustainable energy and became more interested in those topics, even if they already had strong beliefs about human-caused climate change. They also felt more encouraged to take action to reduce their own energy consumption, and as stated above, wanted to seek out new resources for their own intellectual benefit and for use in conversation. Together, these impacts result in a more involved, informed, and active populace who can take what they have learned from ETOM and apply it within their own physical and social communities.

Finally, one of ETOM's most important contributions is in providing a successful example of an integrated approach to science communication. Audiences encountered ETOM in multiple ways, through television programming, museum outreach events, a dynamic website, and various social media—and numerous participants experienced ETOM through more than one method. Although there were challenges inherent in coordinating such a large-scale effort (i.e. communicating with project partners and ensuring that the ETOM media launched around the same timeframe), ETOM's multi-pronged strategy successfully engaged audiences. Each component reached different, but complementary, audiences (i.e., PBS viewers, museum members, and online visitors) with some overlap and at distinct levels of scale. ETOM's multiple modalities allowed for different access points and forms of engagement with the material, so ETOM was well-positioned to support those who wanted to find out more about climate science. The project team was also able to leverage the strengths and capabilities of the four types of media to focus in on discrete outcomes. For example, the television programs concentrated on information dissemination and learning goals, while the online elements mainly targeted activities and mechanisms to encourage individual action and sharing of information with others. If the project team had decided to only design a single experience, they might have missed opportunities to interact with and

impact these audiences around science content. Thus, a core strength of the project is its cumulative impact on participants' content knowledge and behaviors, which likely could only have been achieved by incorporating multiple media.

ETOM was well-positioned to accomplish its objectives, perhaps because its resources were available at a time when extreme weather events were increasingly becoming part of the public conversation. The project's innovation and longevity lie in its ability to bridge more traditional ways of disseminating and viewing science content with new and powerful social media outlets which support active engagement. ETOM was successfully able to merge traditional and current methods of communication, and audiences responded by becoming more informed, engaged, and willing to share what they had learned about climate change and sustainable energy with others. Rather than simply watch, ETOM participants emerged ready to act.

Appendix A: ETOM Television Program Data Collection Instruments

About the Television Program

1.) Did you watch the program Earth: the Operators' Manual?

- Yes
- No

2.) How did you hear about this program? [check all that apply]

- Channel Listings
- Commercial
- Website
- Social Media
- Word of mouth
- Newspaper
- E-mail
- Didn't hear about it before hand.
- Other _____

3.) Why did you decide to watch this program? [check all that apply]

- I am interested in the topic.
- My friend/family member wanted to watch it.
- I love PBS.
- The program was on at a convenient time.
- For Richard Alley.
- Other _____

4.) Did you watch the entire program?

- Yes
- No

5.) How did you watch the program?

- Live on PBS
- Recorded to watch it later
- on DVD
- Online
- Other _____

6a.) Is there any new information that was presented in the program about climate change or sustainable energy that you didn't know before?

- Yes
- No

6b.) What new information did you find out about climate change or sustainable energy?

7a.) Did the program raise any questions for you about climate change or sustainable energy?

- Yes
- No

7b.) What questions were raised?

8.) This program...

	Strongly Disagree	Disagree	Agree	Strongly Agree
increased my interest in this topic.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
presented this information in a way I hadn't seen before.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
gave me new information about climate change.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
gave me new information about sustainable energy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
changed my perspective on environmental issues.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
encouraged me to take action.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
makes me want to seek out further resources or information.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
encouraged me to have discussions about this topic with others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

9.) I feel like expert opinions were presented during the program around these topics.

- Yes
- No

10a.) Did this program meet your expectations?

- Yes
- No

10b.) Please explain how it met or failed to meet your expectations.

11a.) Is there anything that you think was missing from the program?

- Yes
- No

11b.) What did you think was missing?

Other Earth: The Operators' Manual Activities

12a.) Did you visit the *Earth: The Operators' Manual* website?

- Yes
- No

12b.) What portions of the website did you visit? [check all that apply]

- The Program
- Climate Change
- Sustainable Energy
- What You Can Do
- National Outreach
- For Educators
- Resources
- Other _____

13.) Which was your favorite and least favorite section of the website? Please explain.

14a.) Is there any new information that was presented on this website about climate change or sustainable energy that you didn't know before?

- Yes
- No

14b.) What new information did you find out about climate change or sustainable energy?

About Environmental Issues

15.) Do you think that climate change is happening?

- Yes, and I'm extremely sure.
- Yes, and I'm very sure.
- Yes, and I'm somewhat sure.
- Yes, but I'm not at all sure.
- No, and I'm extremely sure.
- No, and I'm very sure.
- No, and I'm somewhat sure.
- No, but I'm not at all sure.

16.) Assuming climate change is happening, do you think it is ...

- Caused mostly by human activities
- Caused mostly by natural changes in the environment
- Other
- None of the above because climate change isn't happening

17.) What kinds of evidence have you heard for or against climate change?

18.) Before today, how much had you thought about...

	Not at all	A little	Some	A lot
climate change.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
sustainable energy alternatives.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

19.) How much do you agree or disagree with the following statements:

	Strongly Disagree	Disagree	Agree	Strongly Agree
"I could easily change my mind about climate change."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
"I could easily change my mind about sustainable energy alternatives."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

20.) People disagree whether the United States should reduce greenhouse gas emissions on its own, or make reductions only if other countries do too. Which of the following statements comes closest to your own point of view? The United States should reduce its greenhouse gas emissions ...

- Regardless of what other countries do
- Only if other industrialized countries (such as England, Germany and Japan) reduce their emissions
- Only if other industrialized countries and developing countries (such as China, India and Brazil) reduce their emissions
- The US should not reduce its emissions

21.) What are some examples of sustainable energy alternatives that you have heard about?

22.) On some issues people feel that they have all of the information they need in order to form a firm opinion, while on other issues they would like more information before making up their mind. For sustainable energy alternatives, where would you place yourself?

- I need a lot more information
- I need some more information
- I need a little more information
- I do not need any more information

23.) How much do you think an individual's actions can reduce personal contribution to climate change?

- Don't know
- Not at all
- Only a little
- A moderate amount
- A great deal

24.) Do you feel like you understand the costs associated with implementing sustainable energy solutions?

- Yes
- No

25.) How confident are you that alternative energies can provide solutions to energy shortages?

- Very Confident
- Confident
- Not Confident
- Very Unconfident

About you

26.) Gender:

- Male
- Female

27.) Age:

- Teens
- 20's
- 30's
- 40's
- 50's
- 60's
- 70's
- 80's
- 90+

28.) In which state do you currently reside? [dropdown list]

29.) In which country do you reside? [dropdownlist]

30.) In which city?

31.) What is the highest level of education you have completed?

- Less than High School
- High School / GED
- Some College
- 2-year College Degree
- 4-year College Degree
- Masters Degree
- Doctoral Degree
- Professional Degree (JD, MD)

32.) What is your race?

- White/Caucasian
- African American
- Hispanic
- Asian
- Native American
- Pacific Islander
- Other

33.) Do you visit science websites?

- Yes
- No

34.) Do you watch PBS?

- Yes
- No

ETOM Television Program One Focus Group Protocol

Now I'd like to ask you all some questions about what you just saw. Please be as honest as possible in your responses. You don't have to answer every question, but I'd like to hear from everybody. Let's get started.

1.) If you had to describe this program to someone who hadn't seen it, what would you tell them about it?

2.) What are some specific things you learned from this program?

- 3.) Did you feel that this program was a credible source of information? What about the host of the program (Richard)?
- 4.) Did you think that this program was cohesive in presenting the information and the arguments were clear?
 - a.) Was there anything that confused you? Do you have any lingering questions regarding terms or concepts covered in the program?
- 5.) What arguments were convincing and what arguments were not?
 - a.) Were there any new arguments seen in this program that you hadn't seen in other programs?
 - b.) Did you feel like some arguments did not present the whole picture? [Prompt : Was there information that you felt was missing or should be covered more thoroughly?]
- 6.) What was the overall tone of the program? [Prompt: Do you feel like the program portrayed positive steps being taken to address climate change?]
- 7.) Does the program make you think differently about or care more about the topic of climate change or alternative energies? [Prompt: Or did the arguments made provide additional support for your views on the issue? Or challenge our current beliefs?]
- 8.) Do you think that the alternative energies presented in the program are effective solutions?
- 9.) Now let's talk a bit about the presentation of information in the program. What are two adjectives you would use to describe the host.
- 10.) So, the program is called Earth: The Operators' Manual. Were you able to follow that thread through the program? How could that thread be touched upon throughout the show?
- 11.) The narrator in the roughcut is temporary. For the final program, would you want the balance of talking as it is now or would you like less Richard, more narrator? Or More Richard, less narrator?
- 12.) Keeping in mind that this is a rough cut, how do you think this program compares to similar programs on PBS, NOVA or Discovery specials?
- 13.) Let's talk about the military segment. The producers think this clip is too long. Are there places that you would make cuts? From what you can recall, what information would you want them to keep in the segment?
- 14.) What did you think about the Texas Wind segment as a whole? What did you like about it? [Prompt: Did the fact that it took place in the United States make it feel more relevant?] Was there anything you didn't like or thought could be improved?

ETOM Television Program Two Focus Group Protocol

This is a rough cut. In many places, you hear the voice of the program's editor, supplying purely temporary narration. He won't be in the final program. In several places, you see the word TEMP on screen. That indicates what's called stock footage that is "work print" (low in technical quality) that will be replaced in the final version. And in some places the audio is too low, or too high, or the music is too loud. Please try to respond to the content of the rough cut, which regular audiences never get to see and not get distracted by aspects of this work in progress.

Now I'd like to ask you all some questions about what you just saw. Please be as honest as possible in your responses. You don't have to answer every question, but I'd like to hear from everybody. Let's get started.

- 1.) If you had to describe this program to someone who hadn't seen it, what would you tell them about it?
- 2.) What are some specific things you learned from this program? Were there any new arguments or ideas that you had never heard or seen before?
- 3.) Did you feel that this program was a credible source of information? What about it made you feel that way?
- 4.) Did you think that this program was cohesive in presenting the information and that the arguments were clear? Were you able to follow the program and understand where it was going?
 - a.) Was there anything that confused you? Do you have any lingering questions regarding terms or concepts covered in the program?
- 5.) Were there any segments that were more convincing than others? Less convincing?
 - a.) Was there information that you felt was missing from the program or should be covered more thoroughly? (Prompt: What other aspects of sustainable energy options would you have liked to hear more about?)
- 6.) What was the overall message of the program? [Prompt: What were the producers trying to explain or have you think about?] What was the overall tone of the program? [Prompt: Do you feel like the program portrayed positive steps being taken to address sustainable energy alternatives?]
- 7.) Does the program make you think differently about or care more about the topic of sustainable energies? [Prompt: Or did the arguments made provide additional support for your views on the issue? Or challenge your current beliefs?]
- 8.) Do you think that the alternative energies presented in the program are effective solutions?

9.) The program is called Seven Ways To Power the Planet, were you able to follow that thread through the program? When you hear/heard that title, what did you think you might be seeing and hearing?

10.) Keeping in mind that this is a rough cut, how do you think this program compares to similar programs on PBS, NOVA or Discovery specials?

Now I'd like to discuss each of the specific segments of the program and get your reactions to them. I'll be projecting a screenshot from each segment to help jog your memory.

11.) The first segment I'd like to talk about is Grow Your Own, the sugar cane ethanol segment.

a.) What do you remember from this segment? What new information or messages did you take away from the segment? [Prompt: What were some of the natural resources or situations that made the adoption of ethanol possible?]

12.) Light Bulbs in the Desert/Solar power

a.) What do you remember from this segment? What new information or messages did you take away from the segment? [Prompt: Were you surprised to find out that solar power systems were invented over 100 years ago?]

13.) Let a Thousand Flowers/China segment

a.) What do you remember from this segment? What new information or messages did you take away from the segment? [

14.) Yes, In My Backyard/Wind

a.) What do you remember from this segment? What new information or messages did you take away from the segment? [Prompt: What are some of the benefits and drawbacks of large-scale implementation of wind power faced by communities in Texas and Denmark?]

15.) Toilets and the Smart Grid

a.) What do you remember from this segment? What new information or messages did you take away from the segment? [Prompt: Had you ever thought about the "technology" of waste management? What did you think about the analogy between waste management systems and alternative energy systems?]

b.) What did you think of the re-enactment of the scene from Scotland with the English visitor? Did it help explain the analogy?

16.) Avoid the Energy Abyss/ Shell

a.) What do you remember from this segment? What new information or messages did you take away from the segment?

b.) Did you notice the former position of the man talking about the US and the energy abyss? Do you think former Shell Oil executive John Hofmeister seemed credible? Do you think what he says has some value in an election year?

17.) Face Reality, Act Accordingly/Lincoln

- a.) Do you know why the story of Lincoln and ironclads was included?
- d.) What new information or messages did you take away from the segment?
- e.) What did you think about this segment as the conclusion of the program?
[Prompt: What was the logical conclusion of the program for you? What did you expect to hear?]

18.) Were there any lingering issues or ideas that you felt were missing from the program as a whole?

19.) Do you think there was enough science in the program, too much science, or not enough science? [Prompt: What makes you say X?]

Now I'd like to show you another clip that the producers are thinking about including in the program. After you watch, I'd like to ask you a few questions about it?

- a.) What did you think about the segment as a whole? What did you like about it?
- b.) Do you think this segment fits in with the overall theme of the program? Why or why not?
- c.) Was there anything you didn't like or thought could be improved about this segment?
- d.) What new information or messages did you take away from the segment?

That was my last question for you. Thanks for your valuable feedback.

Appendix B: ETOM Museum Outreach Event Data Collection Instruments

ETOM Museum Outreach Event Survey

1.) Where was the event you attended?

- Fleet Center - San Diego
- Science Festival - San Diego
- North Carolina Museum of Natural Sciences - Raleigh
- Oregon Museum of Science and Industry - Portland, OR
- Science Museum of Minnesota - St. Paul
- Fort Worth Museum of Science and History - Fort Worth

2.) How did you hear about this museum event? [check all that apply]

- Word of mouth
- Newspaper
- Flyer/Signage around town
- Museum website
- E-mail
- Social Media
- Other _____

3.) Why did you decide to attend this museum event? [check all that apply]

- I am interested in the topic.
- My friend/family member was going.
- I love this museum.
- Speaker(s) at the event
- The format of the event
- Other _____

4.) What kind of event did you attend?

- Ask a Scientist event
- Outdoor Festival Presentation
- Lecture with Richard Alley
- Military presentation
- Science Cafe
- Discussion Forum
- Lecture with other presenter
- Other _____

5.) Was there any new information presented about climate change or sustainable energy that you didn't know before? If so, what?

6.) Did the event raise any questions for you about climate change or sustainable energy?
Was there any information that you felt wasn't discussed or was left out?

7.) This event...

	Strongly Disagree	Disagree	Agree	Strongly Agree
increased my interest in this topic.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
presented this information in a way I hadn't seen before.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
gave me new information about climate change.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
gave me new information about sustainable energy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
changed my perspective on environmental issues.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
encouraged me to take action.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
makes me want to seek out further resources or information.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
encouraged me to have discussions about this topic with others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

8.) Do you have any suggestions for ways to improve this event?
Other Earth: The Operators' Manual Activities

9.) Have you watched the *Earth: The Operators' Manual* program?

- No
- No, but I plan to.
- Yes, live on PBS
- Yes, recorded to watch it later (DVR)
- Yes, on DVD
- Yes, online
- Other _____

10.) Have you visited the Earth: The Operators' Manual website?

- Yes
- No

11.) If you watched the television program or visited the website, what new information did you find out about climate change or sustainable energy?

About Environmental Issues

12.) Do you think that climate change is happening?

- Yes, and I'm extremely sure.
- Yes, and I'm very sure.
- Yes, and I'm somewhat sure.
- Yes, but I'm not at all sure.
- No, and I'm extremely sure
- No, and I'm very sure.
- No, and I'm somewhat sure.
- No, but I'm not at all sure.

13.) Assuming climate change is happening, do you think it is ...

- Caused mostly by human activities
- Caused mostly by natural changes in the environment
- Other
- None of the above because climate change isn't happening

14.) Before today, how much had you thought about...

	Not at all	A little	Some	A lot
climate change.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
sustainable energy alternatives.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

15.) On some issues people feel that they have all of the information they need in order to form a firm opinion, while on other issues they would like more information before making up their mind. For sustainable energy alternatives, where would you place yourself?

- I need a lot more information
- I need some more information
- I need a little more information
- I do not need any more information

16.) How much do you think an individual's actions can reduce personal contribution to climate change?

- Don't know
- Not at all
- Only a little
- A moderate amount
- A great deal

17.) Do you feel like you understand the costs associated with implementing sustainable energy solutions?

- Yes
- No

18.) How confident are you that alternative energies can provide solutions to energy shortages?

- Very Confident
- Confident
- Not Confident
- Very Unconfident

About you

19.) Gender:

- Male
- Female

20.) Age:

- Teens
- 20's
- 30's
- 40's
- 50's
- 60's
- 70's
- 80's
- 90+

21.) What is the highest level of education you have completed?

- Less than High School
- High School / GED
- Some College
- 2-year College Degree
- 4-year College Degree
- Masters Degree
- Doctoral Degree
- Professional Degree (JD, MD)

22.) What is your race?

- White/Caucasian
- African American
- Hispanic
- Asian
- Native American
- Pacific Islander
- Other

23.) Any additional comments:

ETOM Museum Outreach Event Observation Prompts

-Approximately how many people? Age range, genders, are there mostly families, adults only, etc.?

-Describe the activities that take place.

-At what points does the audience seem most engaged?

-Write down any questions people ask or things they bring up about climate change and/or sustainable energy topics.

-What are the general reactions to Richard?

ETOM Museum Outreach Event Interview Protocol

Hi, my name's _____ and I am helping the organizers of this event find out more about what people thought about it. Would you mind answering a couple of questions about it? Do you mind if I audio record your responses so I can remember what we talked about? Great!

1.) How did you hear about this event?

2.) Who did you come with to the event today? Why did you decide to come to this event? What made it stand out?

3.) What did you like about the presentation?

4.) Was there anything that you didn't like or confused you about the presentation?

- 5.) Is there any new information that was presented about climate change or sustainable energy alternatives that you didn't know before?
- 6.) Based on the clips you saw of the television program, *Earth: The Operators' Manual*, what do you think the show is about?
- 7.) Of the topics shown in the clips, which one seems most interesting to you?
- 8.) How likely are you to watch the show on PBS? What intrigues you about it?
- 9.) Are there any reasons you would not watch the show?
- 10.) How likely are you to visit a website connected to *Earth: The Operators' Manual*:
Very likely Somewhat likely or not very likely?
- 11.) What do you want to (or expect to see) on the website?
- 12.) What science websites do you visit? Is there one in particular that you like more than others? Is there one in particular that you would hope the ETOM website emulated? What features do you like about that website?
- 13.) Do you plan on buying Richard's book?
- 14.) Would you attend future events related to ETOM, such as, screenings, lectures, or hands on demonstrations? Which kinds of events are you most likely to attend?
- 15.) Do you have any suggestions for future museum events like this one?

Appendix C: ETOM Website Data Collection Instruments

ETOM Website Survey

About the Website

1.) How did you hear about the *Earth: The Operators' Manual* website? [check all that apply]

- Link
- PBS website
- Social Media
- Word of mouth
- Blog
- E-mail
- Search Engine
- Television Program
- Museum Event
- Other _____

2.) Why did you decide to visit this website? [check all that apply]

- I am interested in the topic.
- I saw the show and wanted more information.
- I wanted to watch the show online.
- Richard Alley is the host.
- It was recommended.
- Other _____
- I am an educator who is looking for resources.
- I went to an event and wanted more information.

3a.) Is there any new information that was presented on this website about climate change or sustainable energy that you didn't know before?

- Yes
- No

3b.) What new information did you find out about climate change or sustainable energy from the website?

4.) This website...

	Strongly Disagree	Disagree	Agree	Strongly Agree
increased my interest in this topic.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
presented this information in a way I hadn't seen before.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
gave me new information about climate change.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
gave me new information about sustainable energy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
changed my perspective on environmental issues.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
is inspiring.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

5.) Now that you have been to the website, how likely are you to do the following?

	Not At All Likely	Somewhat Likely	Likely	Very Likely
Seek out further information or resources on the topic	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have discussions about this topic with others in person or online.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Take personal action to reduce my energy consumption.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Get involved with environmental initiatives in my community or at a national level.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6.) On this website, I... [Check all that apply]

- watched a video clip from one of the broadcasts
- watched an entire episode of the program
- watched one of the web-only videos (OSTRICH, HERO, COMMUNITY, etc.)
- nominated a hero or an operator
- calculated my energy usage
- gathered educational resources
- Other _____
- asked ETOM a question
- used one of the widgets

7.) How else have you interacted with ETOM? [Check all that apply]

- I liked ETOM on Facebook
- I followed ETOM on Twitter
- I shared ETOM info online
- I went to an event
- Other _____

8.) Where do you share ETOM information? [check all that apply]

- On Facebook
- On Twitter
- On my blog
- On someone else's blog
- On discussion boards
- Other _____

Other Earth: The Operators' Manual Activities

9a.) Did you watch an Earth: The Operators' Manual program?

- No
- No, but I plan to.
- Not yet, but recorded to watch it later
- Yes, live on PBS
- Yes, on DVD
- Yes, online
- Other _____

9b.) I watched...

- Earth: The Operators' Manual (Program One)
- Powering the Planet (Program Two)
- Energy Quest USA (Program Three)

About Environmental Issues

10.) Do you think that climate change is happening?

- Yes, and I'm extremely sure.
- Yes, and I'm very sure.
- Yes, and I'm somewhat sure.
- Yes, but I'm not at all sure.
- No, and I'm extremely sure.
- No, and I'm very sure.
- No, and I'm somewhat sure.
- No, but I'm not at all sure.

About you

11.) Gender:

- Male
- Female

12.) Age:

- Teens
- 20's
- 30's
- 40's
- 50's
- 60's
- 70's
- 80's
- 90+

13.) What is the highest level of education you have completed?

- Less than High School
- High School / GED
- Some College
- 2-year College Degree
- 4-year College Degree
- Masters Degree
- Doctoral Degree
- Professional Degree (JD, MD)

14.) What is your race?

- White/Caucasian
- African American
- Hispanic
- Asian
- Native American
- Pacific Islander
- Other
- I prefer not to answer.

15.) Which of the following best describes your political affiliation?

- Strongly Conservative
- Moderately Conservative
- Neutral/Undecided
- Moderately Liberal
- Strongly Liberal
- I prefer not to answer.

16.) What do you do online? [Check all that apply.]

- Search Engine (Google, Yahoo)
- Social networking (Google+, Facebook)
- Chat/instant messaging (AIM, iChat)
- Blogging/micro-blogging (Blogspot, Blogger, Twitter)
- Online Audio Conferencing (Skype, GTalk, Gizmo)
- Social Bookmarking (Delicious, Pinterest, Digg)

Thank you for your feedback!

ETOM Website Focus Group Protocol

1.) So you just watched the program and you are about to go on the website. What do you expect to see there? [Prompt: What do you want to see there?]

2.) What draws your attention. Where does your eye go first?

3.) If you were to go to a site like this, what would you click on first based on your own interests?

4.) Based on what you see on the screen, what do you think you'll be able to do on the website?

5.) Do you think you'll get reliable information on this website? [Prompt: Do you think you'll find answers to any lingering questions?]

6.) Where would you go based on your own personal interest?

7.) Based on the fact that when you open it, this is what you see, but there's all this other stuff going on at the bottom, where would you want information to be on the page?

8.) Is there anything on the homepage you would take out or move to another page?

For each section participant mentioned, the following questions were asked:

9.) So here's the X section, was that what you expected to see there?

10.) How would you use this section of the website? [Prompt: Where would you go first? What would you do here?]

11.) Did you find out anything new that you didn't know before?

12.) Is there anything you would remove from this page? Is there anything you would add?

13.) Now what would you do? Why would you go there?

14.) What kinds of features would the website need to have to keep you coming back/for you to revisit the site?

Appendix D: ETOM Facebook Data Collection Instruments

ETOM Facebook Survey

Please answer the questions below.

1.) How did you locate the *Earth: The Operators' Manual* Facebook page? [check all that apply]

- ETOM website
- Social Media
- Word of mouth
- Blog
- E-mail
- Search Engine
- Television Program
- Museum Event
- Other _____

2.) Now that you have seen the Facebook page, how likely are you to do the following?

	Not At All Likely	Somewhat Likely	Likely	Very Likely
Seek out further information or resources on the topic	○	○	○	○
Have discussions about this topic with others in person or online.	○	○	○	○
Take personal action to reduce my energy consumption.	○	○	○	○
Get involved with environmental initiatives in my community or at a national level.	○	○	○	○

3.) How else have you interacted with ETOM? [Check all that apply]

- I shared ETOM info online
- I followed ETOM on Twitter
- I went to the ETOM website
- I watched the ETOM television program(s)
- I went to an event
- Other _____

4.) Where do you share ETOM information? [check all that apply]

- On Facebook
- On Twitter
- On my blog
- On someone else's blog
- On discussion boards
- Other _____

5a.) Which do you prefer to visit?

- ETOM Facebook page
- ETOM website
- I have no preference

5b.) Why do you prefer the ETOM Facebook page to the website?

5c.) Why do you prefer the ETOM website to the Facebook page?

6.) Do you think that climate change is happening?

- Yes, and I'm extremely sure.
- Yes, and I'm very sure.
- Yes, and I'm somewhat sure.
- Yes, but I'm not at all sure.
- No, and I'm extremely sure.
- No, and I'm very sure.
- No, and I'm somewhat sure.
- No, but I'm not at all sure.

7.) What is the highest level of education you have completed?

- Less than High School
- High School / GED
- Some College
- 2-year College Degree
- 4-year College Degree
- Masters Degree
- Doctoral Degree
- Professional Degree (JD, MD)

8.) Which of the following best describes your political affiliation?

- Strongly Conservative
- Moderately Conservative
- Neutral/Undecided
- Moderately Liberal
- Strongly Liberal
- I prefer not to answer.

Thank you for your feedback!

ETOM Facebook Focus Group Protocol

Thank you all for agreeing to participate in the ETOM Facebook online focus group. During the focus group, feel free to ask questions, make comments, and share your opinions about the Facebook page. Please be as honest as possible, I/we want to hear what you think. Also, feel free to respond to other people's comments. Obviously, use online etiquette (no name calling, profanity, etc.). You don't have to answer every question I ask, but I would like to hear from everyone at multiple points. Any questions before we get started?

1.) Where did you find out about the ETOM Facebook page?

2.) So, why did you decide to seek out/click through to the ETOM Facebook page? What appealed to you about it?

3.) What makes this page unique? What makes you want to follow ETOM's Facebook page as opposed to all the other groups you could be following?

4.) Is there anything about the ETOM FB experience surprised you?

5.) What POV do you think ETOM is expressing on climate and energy? Do you think this POV is very common or pretty unique?

6.) Does ETOM make you feel more hopeful that we can make progress toward a better future on energy and climate? Why/why not?

- 7.) What information on the Facebook page did you find most interesting or useful (videos, posts to other sites, the HOW GREEN ARE YOU quiz, climate content, energy content, ways to save money, “calls to action”, etc.)?
 - a. Why was that information useful? How did or do you plan to use it?
 - b. Would you use that information in a discussion about climate change or sustainable energy with others? How? In what situations?
 - c. Have you been to the ETOM website? If so, do you prefer to use Facebook than a website?

- 8.) Did you post on the Facebook page or respond to other’s posts with your Comments?
 - a. What drew you to Comment? What sort of information did you get from the thread/discussion? What makes that sort of information valuable to you?
 - b. Were there particularly lively or memorable discussions or Comment threads? Tell me more.

- 9.) If you haven’t posted on the Facebook page, what would encourage you to post?
 - a. Are you more likely to post about certain topics more than others? Which ones?

- 10.) Are you involved in any environmental organizations or initiatives?
 - a. Does the Facebook page inspire you to join such organizations or initiatives?
 - b. Do you see this as a political issue? Do you think ETOM has a political position?
 - c. Are there specific political actions you think you would be encouraged to take on? For example, do you plan to start campaigning on green initiatives or take other political actions as a result of participating on the Facebook page?

- 11.) Do you feel like the site gave you a sense of the kinds of individual, community, or national actions you can take? In what ways?

- 12.) Is there anything else you’d like to see on the page or like ETOM to post about?
 - a. Is there information or viewpoints that you feel are missing from the page?

- 13.) Any other information you would like to share about the Facebook page?

Appendix E: Concepts Viewers Learned From the Television Programs

Climate Change Concepts

"The weight of the CO₂ we measure is from old plants being burned, which points the finger at fossil fuels."

"The stuff about what Carbon 12, 13, and 14 are. I mean, I'd heard that stuff before, but I didn't realize that Carbon 12 is plants. Carbon [inaudible] is radioactive."

"Fossil fuels contain the CO₂ that initially helps plants grow. When we burn fossil fuels, we are releasing those trapped CO₂ molecules."

"How the air bubbles from thousands of years get trapped in the glaciers, which leads to being about to see the air from that time period."

"We are shooting past the 380 mark for CO₂, which hasn't happened for 800,000 years or more with no signs of slowing."

"The effect of the tilt of the earth's axis over the past 41,000 years and how the shift in sunlight affects or influences the climate."

"Historical CO₂ trends can be documented from glacial ice cores."

"The direct link between the burning of fossil fuel and climate change."

"I learned how air samples are tested in the ice layers, how the levels of CO₂ have tracked closely with temperature up until the Industrial Revolution, and how our use of fossil fuels needs to change in order to keep our planet from self destructing!"

Military Energy Use

"The statistics were shocking; I was surprised it said that by 2030 all military bases would be self-sustaining."

"[I] never suspected the military to be leading the way."

"I thought that was interesting that the hummer uses for every 4 miles, it uses X amount of gas, that tanks use X amount of gas...That was something tangible that I didn't know and I thought, "Wow. That's a waste."

Examples of Alternative Energies

"I hadn't realized Houston was as forward-thinking as it is."

"How much energy we have on earth. And the great potential for all the renewables. It blew away that we aren't using these technologies today."

“Alternatives already under development across the world. How the US is falling further behind.”

“Mainly I didn't realized how feasible "alternative" energy sources really are. Also I didn't realized how a proponent of science, especially wind power, Lincoln was.”

“That there are small things that can be done to change the way we consume energy now, that will have a long term impact.”

Appendix F: Concepts Viewers Learned From Museum Outreach Events

Climate Change

"I felt like it was the most thorough or just the most clear explanation of linking carbon dioxide to climate change - Obviously, I have heard these things over the course of my education. I hear it all the time in seminars and stuff, but he just linked everything together really clearly. Just some of the ways of measuring CO₂ in ice cores, some of the ways of calculating temperature and correlation between historic carbon absorption and release having to do with like the tilt of the earth. So just tying all of those individual pieces together to form that historic map of where we are today was - With the bald spot. Beautiful. I'll have that vision in my mind forever." (SMM Richard Lecture)

"The scientist gave some interesting facts about how air samples are being extracted from Glaciers that are thousands of years old. And from those sample are able to accurately measure and display how the CO₂ levels change." (Fleet Richard Lecture)

"Rate at which carbon is currently being generated (and the cycles of carbon in the atmosphere before)... put it very neatly into perspective." (Fleet Richard Lecture)

"Climate change is occurring and the human population will reach a billion by 2050, which will lead to more CO₂ emissions and food shortages." (NCMNS Lecture)

"I didn't know that so many people were "touched" by the effects of global warming." (NCMNS Lecture)

"He's a glaciologist, and that the ice is two miles deep and it goes in layers and they make ice cores. We didn't know that you could really see the layers of these glaciers. That you could go 200,000 years deep. Able to see different pieces of history, volcano eruptions from around the world." (San Diego Science Festival)

"The ice core info from Antarctica and how each person's personal habits add up to make a bigger effect." (San Diego Science Festival)

"Sharp contrast between historical changes and current conditions." (OMSI Science Pub)

"About climate change what impressed me was the rate of change and the scale and how fast it's happening. That was new to me." (OMSI Science Pub)

"Understanding PPM measurements." (OMSI Science Pub)

Sustainable Energy Alternatives

"The Lincoln interest in wind." (OMSI Science Pub)

Solar power plants in Spain And technology of guy in 1910 solar = steam power." (OMSI Science Pub)

"Energy! Who knew? Houston #1 user of sustainable." (OMSI Science Pub)

"That it would only take 1% of GDP to get completely renewable energy." (OMSI Science Pub)

"The connection between modern plumbing and new energy resources was something I had never considered." (OMSI Science Pub)

"That Abe Lincoln and other people way back when already advocated renewable energy."(SMM Richard Lecture)

"It was very interesting how we were involved in some of these energies quite some time ago. I wasn't aware of some of those things. The specific information he offered with what's happening with the CO₂ and what effects that actually has and how that was determined some time ago with the Air Force. I wasn't aware of that." (SMM Richard Lecture)

"I thought the comparison to plumbing was amazing. I hadn't heard that before. But it was a really good connection when people say, 'We don't have the money, we don't have the resources, we don't have the energy to make this sort of major shift. I thought it was a really amazing point." (Richard Lecture)

"I learned about how African people in slum area generate energy by using solar panels. also why the risk of earth quakes are raising. / Global warming that change environment and temperature of our earth." (NCMNS Lecture)

"If we were to put wind farms in JUST deserts and prairies in windy areas, we could produce 5x current human energy use!" (SMM Richard Lecture)

"I wasn't aware that Brazil really struggled for 30 years to develop transportation based on sugar cane/ethanol and how much government and industry work together to get to their current solution. Disheartening to think about when you observe how American politics works today." (NCMNS Lecture)

"I did not know how little the US spends on energy science." (NCMNS Lecture)

Military Energy Use

"Local sustainability programs available for the DOD facilities and technologies for forward operation areas to be less dependent on carbon fuels." (Fleet Military Presentation)

"On the topic of fuel cells and how much energy independent the military wants its installations to be in the next five years, ten years." (Fleet Military Presentation)

"It's staggering what war requires. It's like what Napoleon used to say, 'An army can't run without food.' Now foods almost easier than fuel I would say...It's just nice to come and hear the specifics of it." (Fleet Military Presentation)

"I was very enlightened by what the military is doing to develop multiple uses of sustainable energy in all the branches and at all levels." (Fleet Military Presentation)

"The effort and extent of the DOD commitment to sustainable energy both at home and overseas. The proof and value of alternative fuels and power sources. The future continuation of "green alternatives" by service folks' command." (Fleet Military Presentation)

Other

"Tsunami as recently as 1930 and still nuclear plant in Japan not fortified against such a disaster till mid-2000s." (NCMNS Lecture)

"Learned more about ways to communicate science." (NCMNS Lecture)

"Coal to oil conversion."(NCMNS Lecture)

Appendix G: New Information Participants Found Out About From the ETOM Website

Climate Change Concepts

"How the different carbon helps to define the problem and that CO₂ has been increasing and O₂ decreasing, pointing to combustion as the cause."

"El Niño Southern Oscillation (ENSO)."

"The Carbon fingerprint of fossil fuel carbon vs. volcanic or natural."

"The great amount of snowfall feeding glaciers, the large number of people transitioning to intensive energy use, how CO₂'s blocking of heat was discovered, how it is known that CO₂ increases are coming from fossil fuels."

"The speed that we are going to a problem!"

"Atmospheric research by DOD, during the development of heat-seeking missiles, contributed to the discovery of global warming."

"I read the article about the Great Barrier Reef and how coral shows effects of climate change and warming sea temps. The graphics were a great addition as well."

"I knew CO₂ levels were exasperated by man, but not how significantly. The information about why it's human caused and not a natural cycle. The many options out there for getting off of fossil fuels."

"Three basic types of carbon. Volcanic, Fossil, and Living."

"40% of CO₂ we generate is absorbed by Oceans."

Alternative Energies

"Some of the stats about energy usage were new to me, and helped me to think more about how huge this problem will be."

"Through the sustainable energy quiz - I didn't know a lot of the answers, so it was great to learn!"

"I was unaware of all the initiatives Houston is doing in terms of efficiency."

"That geothermal has the least potential energy generation."

"What other countries are specifically doing to address the issue and create change."

"Having the various energy options shows that technology is available and the political presentations have not been totally truthful."

“How some breakthrough technology is use by the military and the sustainable energy programs other nations are implementing.”

“The information on community energy competitions.”

“What Alaska is doing to become more sustainable and the other American cities featured, China and Brazil's projects in more depth.”

“The [clip] comparing sewage disposal in London in past centuries (tipping it out the window) and CO₂ disposal today was a great comparison. I plan to use that in my teaching.”

“That clean coal technology, while not the only solution, can be of help in transforming how we use energy more sustainably.”

“History of solar technology, mechanism of energy production from solar energy, current state of science/technology.”

Military's Use of Sustainable Energies

“That the US military is leading the way in developing clean green technologies and that, by the way, is no small thing!”

“The military uses forms of sustainable energy to reduce fossil fuel.”

Politics

“That a registered Republican could be open to understand, debate and even defend the issue!”

“I received the impression from the site that support for doing something about climate change is more widespread across the political spectrum. I also learned that some presentations of climate change impacts are deliberately using the rhetoric of positiveness and trying an upbeat message. I'm not sure that's going to work.”

Personal Energy Consumption

“I am an energy hog.”

“I learned that I'm already doing well reducing my energy consumption, but that there is more I can do.”

Appendix H: ETOM Facebook Post Coding Scheme

Date of Post: Month/Day/Year

Post Title:

1 Energy Operator/Hero


 EARTH-The Operators' Manual
May 18

ETOM'S EARTH OPERATOR OF THE WEEK:
Thomas Salamone, for his work in greening the roofs of New York. He is responsible for maintaining the largest green roof in NYC at Silver Cups Studios. Founder of the community group Sustainable Greenville,...[See More](#)




Like · Comment · Share 45 12

2 ETOM Tip of the Day

 EARTH-The Operators' Manual
September 6


ETOM Tip of the Day:
Properly inflating your tires can improve gas mileage by 3.3%, saving over 1.2 billion gallons of oil per year.



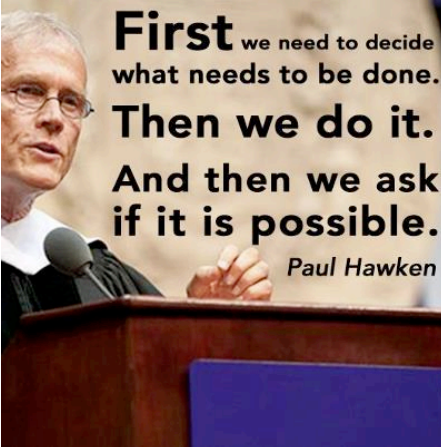
SAVE 1.2 BILLION
gallons of oil per year.
Properly inflate your tires.

Like · Comment · Share 150 6 80

3 ETOM Quote of the Day


 EARTH-The Operators' Manual
July 18

ETOM QUOTE OF THE DAY:
"First we need to decide what needs to be done. Then we do it. And then we ask if it is possible." Paul Hawken
What needs to be done regarding the climate and energy crisis?




Like · Comment · Share 49 8 23

4 Talk to An Ostrich

 EARTH-The Operators' Manual
July 9

HOW TO TALK TO AN OSTRICH:
"Earth's Climate Changes Gradually... We Can Easily Adapt." Sometimes, but other times it's more like bungee jumping off a roller coaster. ETOM's Richard Alley demonstrates!
http://www.youtube.com/watch?v=DiM1DSmCSuc&feature=player_embedded#




Like · Comment · Share 19 4

5 Not Categorized
 Post does not have an official title
 and contains non-promotional content.

EARTH-The Operators' Manual
 July 1

1,924 – The number of daily high temperature records set in the last week of June. Year to date, warm temperature records have been outnumbering cold records by about 7-to-1.
<http://www.climatecentral.org/blogs/heat-wave-sets-more-all-time-temperature-records?utm-source=feedburner&utm-medium=feed&utm-campaign=Feed%253A+climatecentral%252FjdjOO+Climate+Central+-+Full+Feed>

d Temperatures in the United States



Like · Comment · Share 75 15 111

6 Self Promotion
 Post does not have an official title,
 but is referring specifically to an
 ETOM resource.

EARTH-The Operators' Manual shared a link.
 April 23

Airing tonight on PBS World, 8pm local time: Part 1 of ETOM's 3-part series on climate change and energy. Host Richard Alley goes to the (ice) core of the debate, and shows us that today's climate is unlike anything we've seen in the past 400,000 years. The cause? "It's Us." See what the Pentagon has to say about this, too. Spread the word, watch tonight, get the facts – and then get involved.



Earth: The Operators' Manual | ETOM
 earththeoperatorsmanual.com

An operator's manual helps keep your car or computer running at peak performance. Earth science can

Like · Comment · Share 30 5 15

Post Topic:
 1 Climate Change Fact
 Post shares facts about climate change impact and research.

Jerry Wisely shared a link.
 August 27 near Beaverton, OR

<http://thinkprogress.org/climate/2012/08/26/745571/why-the-arctic-sea-ice-death-spiral-matters/> Arctic sea ice is at a new record low. It's a sign of a hotter planet, but less ice also means the planet absorbs more heat, and our weather get...See More



Why The Arctic Sea Ice Death Spiral Matters
 thinkprogress.org

Arctic sea ice extent takes a nosedive this year. What does it mean for us? (Source: Japan)


Like · Comment · Share

2 Climate Change Editorial

Post may include some facts, but also contains an opinion from ETOM or the person or organization they are posting about regarding climate change research, attitudes, or policies.

 EARTH-The Operators' Manual
September 2

How to Talk to an Ostrich:
"Only tree-huggers think climate change is real."
Not exactly: the Pentagon, mandated to look decades ahead for threats to the nation's security, started factoring climate change into strategic doctrine with the 2010 Quadrennial Defense Review.
http://www.youtube.com/watch?feature=player_embedded&v=5rrk4JNHXdM



Climate change will contribute to food & water scarcity, will increase the spread of disease, and may spur or exacerbate mass migration.
- The Pentagon, 2010 Quadrennial Defence Review

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3 Alternative Energy Fact

Post shares facts about how alternative energies are being used in various communities.

 EARTH-The Operators' Manual
July 25

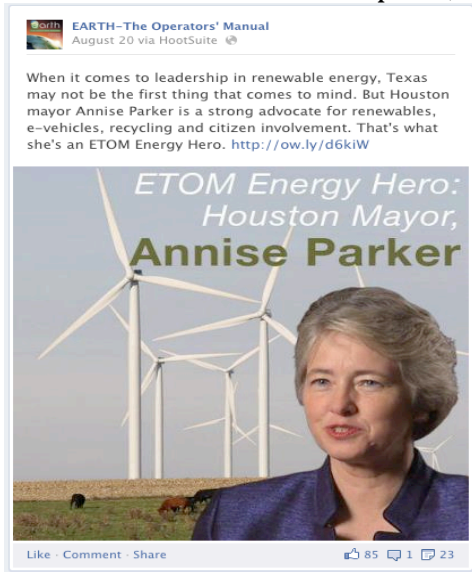
25% – The amount of Germany's gasoline requirements that could be produced from agricultural biomass waste, in climate-friendly cellulose ethanol plants like the one just opened.
<http://www.croplife.com/article/29254/clariant-launches-biofuel-of-the-future>



Like · Comment · Share 56 2 30

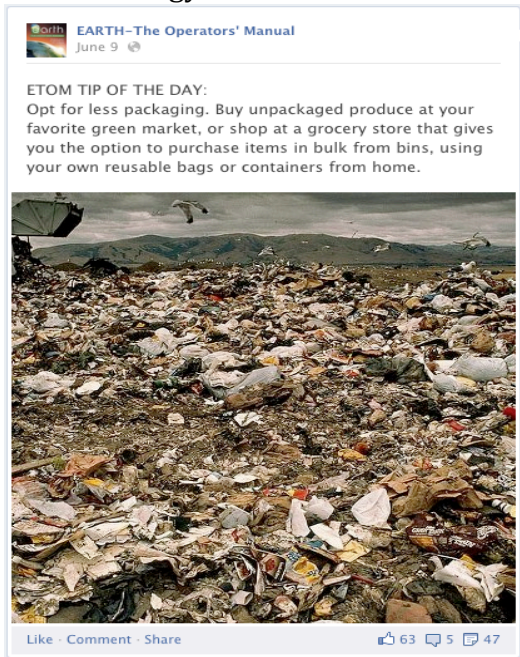
4 Alternative Energy Editorial

Post may include some facts, but also contains an opinion from ETOM or the person or organization they are posting about regarding how alternative energies are being utilized, attitudes towards their adoption, or related policies.



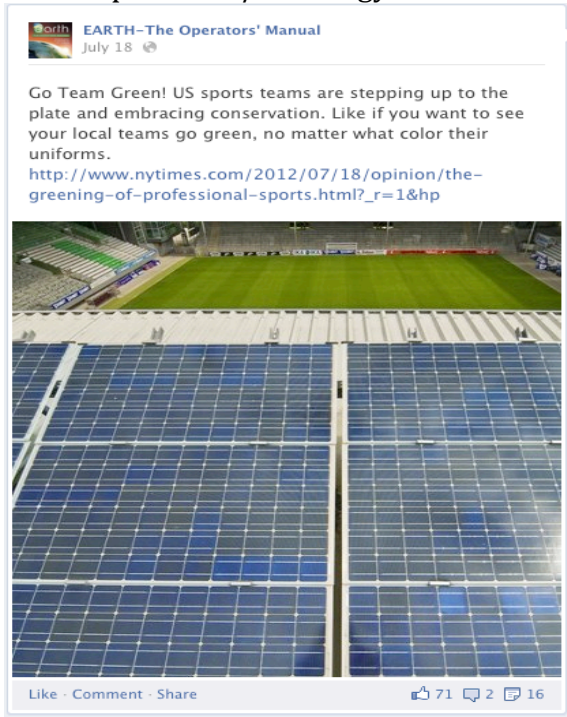
5 Energy Use Fact

Post shares facts about the impact of individual actions on energy consumption and/or on overall energy use in various countries and communities.



6 Energy Use Editorial

Post may include some facts, but also contains an opinion from ETOM or the person or organization they are posting about regarding individual actions to reduce energy consumption and/or energy use.




7 Self Promotion

Post is referring to an ETOM resource without containing any additional content.




Reference to ETOM Resource: Yes/No

Post refers to Richard Alley, the ETOM television programs, website, or other ETOM resources.

 EARTH-The Operators' Manual
August 31

Looking to make your home more environmentally friendly with renewable energy or efficiency upgrades? Use our handy WattzOn rebate finder to find incentives in your area. Follow the link and enter your zip code.
<http://earththeoperatorsmanual.com/feature/calculate-your-energy-use>

Tip: Solar panels come in all shapes and sizes these days. These beautiful Solé Power Tiles™ are made to mimic a traditional clay tile.



Like · Comment · Share 160 13 88

Mentions Politics: Yes/No

Post refers to political parties, voting, governments, or laws.

 EARTH-The Operators' Manual
June 11

Mexican President Felipe Calderon has signed a law introducing binding targets on climate change, making Mexico the "first developing country with integral legislation against climate change." The goal is a 50% reduction in GHG emissions by 2050.
<http://www.bbc.co.uk/news/world-latin-america-18345079>



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Appendix I: ETOM Museum Event Attendance From Observational Data

In April 2011, the Fleet held two evening lectures by Richard Alley, followed by a musical appearance Richard and a meet-and-greet at the San Diego Science Festival. The first evening presentation had between 75-100 attendees. The audience consisted equally of adult-only groups and families. The second presentation had between 150-170 older attendees and a group of donors from a local PBS station. For the afternoon musical appearance, the venue was half-filled and consisted mostly of families. No attendance numbers were collected for the meet-and-greet. The Fleet also held two museum outreach events, a morning Sustainability Workshop and an evening Military Goes Green event in January 2012. Observers indicated that approximately 30 adults attended the Sustainability Workshop. Around 50 people attended the evening Military Goes Green event. Most attendees were adults, but there were also several families from the VIP area who attended the event.

NCMNS held an organized panel presentation, Military Goes Green: Cutting Back on Fossil Fuels to Save Lives and Billions of Dollars, in April 2011. The presentation was a part of the museum's annual Planet Earth Celebration, which also included a Sustainable Design Competition, green Bazaar, and a large variety of educational booths. REA researchers observed the event, which had 35 people attend. The low attendance was likely due to an impending storm, as the museum had advertised the event via loudspeaker and in promotional materials for the festival.

SMM held two events in October 2011. Event observations indicated that 230 people attended an evening lecture by Richard Alley at the museum, while an additional 110 people attended a lecture by Richard the following day.

OMSI held a Science Cafe at OMSI in November 2011. Observers estimated that 350 attended the event. The audience consisted of mostly couples, some adult groups, and only two or three children.