

Innovation Showcase Summative Evaluation

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Prepared for:

COSI

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Executive Summary

The exhibition Innovation Showcase focused on energy-related innovation and individual action. As part of a larger project, Innovations in Energy, the central visitor-focused question for this exhibition was:

To what extent and in what ways do the various components of Innovations in Energy serve toward meeting outcomes for the target audiences?

This summative evaluation of Innovation Showcase addressed this question by identifying how COSI visitors used the gallery space (particularly at the level of individual exhibition elements) and how they described their experience in Innovation Showcase.

Innovation Showcase visitors:

- Reflected *to some extent* the intended audiences of Innovation Showcase. Substantial numbers of adults and older children were observed. However, there were also many groups with young children; no groups of middle or high school students were observed; and adults tended to misinterpret the “bill payer” audience as a “homeowner” audience.
- Had mixed opinions of the exhibition’s intended audience. This lack of consensus is encouraging: it reflects the variety of audiences for whom the space was in fact designed.

Visitors used Innovation Showcase:

- With higher traffic (in terms of both stops and time) and more attention in the front parts of the gallery or where particularly compelling individual elements were located.
- By focusing their attention on the most interactive elements. Media- and artifact-based elements received about one-third as much attention as the interactives; exceptions to this rule were artifacts or media experiences that visitors found particularly relatable to their own lives. Text-only elements received about one-tenth as much attention as interactives.
- Visitors overall were able to recall the elements to which they directed the most attention. This indicates the most attention-holding elements were memorable as well as attractive.

Visitors talked about:

- The innovations and technologies they saw.
- Energy efficiency / conservation – efficiency and how consumers can promote it.
- Connections they made in the exhibition: between elements and / or ideas, between Innovation Showcase and their own experiences, and between what they saw and their own prior knowledge (or new information they wished to learn).

Visitors did not talk about:

- Identifying themselves as potential innovators or someone who was inspired to innovate, or as someone who might aspire to an energy innovation-related career.
- The scale or complexity of energy systems, or energy needs beyond the individual scale.

Overall, these findings shed light on the effectiveness of both individual exhibition elements and their placement within the Innovation Showcase gallery space.



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Introduction

Innovation Showcase is an exhibition at the Center of Science and Industry (COSI) in Columbus, Ohio. Its focus is on energy-related innovation and individual action. This exhibition is one component of a larger multi-year project, Innovations in Energy. Content will be developed further for the second phase of the Innovations in Energy project and some of the elements from Innovation Showcase may be installed in the permanent energy exhibition on COSI's first floor. Thus, while the present report describes a summative study of an exhibition, findings presented here may prove useful for future exhibitions because they address both the effectiveness of Innovation Showcase as a whole and the impact of individual elements within it which may or may not be carried forward.

In its current iteration, Innovation Showcase is situated in a long, narrow gallery on COSI's ground floor. It contains 26 different exhibit panels or areas, each presenting one or more elements – text, visual media, artifacts, and interactives. (See Appendix 1 for a full list and description of these 26 element areas.)

Evaluation Questions

The overarching visitor-focused question for evaluating the broader Innovations in Energy project is:

To what extent and in what ways do the various components of Innovations in Energy serve toward meeting outcomes for the target audiences?

In evaluating Innovation Showcase's effectiveness, this key question was divided into three areas of focus:

Visitors' attention to elements:

- How did visitors move through Innovation Showcase?
- Which elements or topics were they using or attending to the most? The least?
- What did visitors recall about their time in Innovation Showcase? Which visited elements were recalled the most? The least?
- To what extent did visitors recall the elements to which they attended?

Communication of exhibition content:

- How did visitors talk about their interactions with the various elements?
- When asked about Innovation Showcase as a whole, did visitors articulate any of the key messages used by COSI?



- At any point(s) during interviews, did visitor talk indicate any of the short term outcomes desired by COSI?

Target audiences and feel of exhibition:

- Who visits Innovation Showcase? To what extent did the actual audience(s) reflect COSI's target audiences for the exhibition?
- For whom did visitors feel Innovation Showcase was intended?
- How did visitors describe Innovation Showcase when comparing it to the rest of COSI?

Methods

Adult visitors were selected for tracking-and-timing observation on a continuous / convenience basis: the first adult in a group to enter Innovation Showcase was selected for unobtrusive observation and approached for interviewing as they exited the gallery. After the completion of an interview, the first adult of the next available group was selected for the next observation.¹ The visitors observed were general public visitors in family or social groups. Although student groups are a target audience of Innovation Showcase, no reserved or school groups were observed, due both to the complexity of consent / assent for minors, and the fact that no such groups visited the space during data collection.

Information about visitor use of the Innovation Showcase space and individual elements was obtained using tracking-and-timing observations of visitors to the exhibition. To facilitate these observations and later analysis, the gallery was divided into six thematic and spatial areas.² Data about each visitor's stops and path within the space and within each area, about the presence or absence of a series of attention-related behaviors directed at exhibit elements, and observations about the composition of their group (i.e., whether children were present) were collected using maps of the Innovation Showcase gallery (see Appendix 2 for the timing-and-tracking instrument).

Short, semi-structured interviews were also conducted with observed visitors as they were leaving the Innovation Showcase gallery. A total of 25 visitors consented to be interviewed; twenty of the interviews were completed and five were partially completed. These interviews served two purposes. First, visitors were asked to recall what they had just seen and done in Innovation Showcase. Observations and interviews were paired in order to compare these recollections to visitors' observed behaviors. Second, visitors responded to a series of

¹ Some visitors only used the space's non-exhibit amenities (e.g., visiting restrooms or looking for lockers); if a visitor made no other stops and showed no attention behaviors, observations of their visit were removed from the sample and they were not interviewed.

² Area 1 was at the front of the gallery and area 2 was to the right (east) of the entry, along and under a stairwell; areas 3, 4, and 5 were on the left (west) side of the gallery, from front to back, and area 6 occupied the right (east) side of the main gallery space.

questions that pointed to the planned outcomes of Innovation Showcase and the look and feel of the exhibition. They were asked:

- If they had seen anything they could “take away” that might be applicable to their everyday lives
- To describe what they felt the main message(s) of Innovation Showcase might be
- To describe who they felt the target audience(s) of Innovation Showcase might be
- Whether Innovation Showcase looked or felt like the rest of COSI, and why or why not

Observations and exit interviews were paired in order to compare visitors’ activities to their recollections at the individual level. Both tracking-and-timing data and interview data were analyzed using a combination of SPSS 19 and Microsoft Excel; interview responses for visit / exhibit area descriptions were analyzed separately from the remaining interview questions. The former were coded for the frequency of mentions of exhibit elements. The latter were subjected to content analysis at the level of both complete statements and partial statements or phrases, and were coded for the presence or absence of talk related to Innovation Showcase’s planned outcomes, planned key messages, and several other emergent categories.

Findings

Visitors’ Attention to Exhibition Elements

How did visitors move through Innovation Showcase?

On average, visitors spent about five and one half minutes in Innovation Showcase; total times, however ranged considerably, from 1:16 to 28:14 (std. dev. 4:29). Times spent in each of the six exhibit areas also varied widely, though most areas had a median time of between 30 and 45 seconds (see table 1 for details). Figure 1 also describes visitors’ observed times in Innovation Showcase as a whole, showing the proportion of tracked visitors by length of visit.

Table 1: Total Time in Innovation Showcase (n=54)

	Minimum	Maximum	Mean	Std Dev	Median
Time in Area 1	00:00:01	00:12:03	00:01:28	00:02:07	00:00:39
Time in Area 2	00:00:00	00:08:22	00:01:07	00:01:29	00:00:42
Time in Area 3	00:00:00	00:03:44	00:00:22	00:00:39	00:00:08
Time in Area 4	00:00:00	00:06:31	00:01:20	00:01:40	00:00:42
Time in Area 5	00:00:00	00:17:10	00:00:29	00:02:20	00:00:00
Time in Area 6	00:00:00	00:04:30	00:00:42	00:00:54	00:00:30
TOTAL	00:01:16	00:28:14	00:05:33	00:04:29	00:04:14

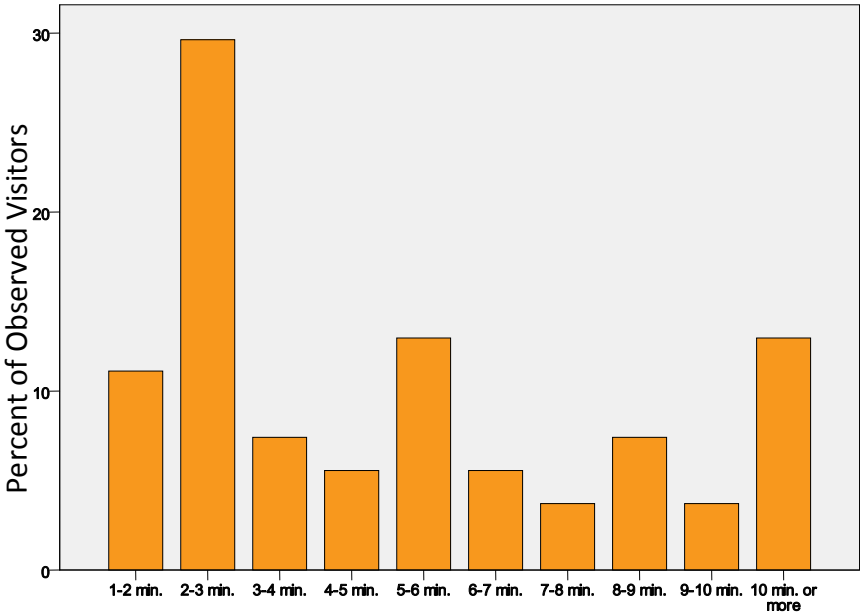


Table 2 shows a second measure of visitor movement: the average number of stops an observed individual made in the different areas of Innovation Showcase. Across all these measures, visitors were more likely to linger in areas 1, 2, and 4 than in areas 3, 5, and 6.

Table 2: Total Stops in Innovation Showcase (n=54)

	Minimum	Maximum	Mean	Std Dev	Median
Total Stops in Area 1	0	6	1.31	1.425	1.0
Total Stops in Area 2	0	8	2.15	2.218	2.0
Total Stops in Area 3	0	3	.63	.875	0.0
Total Stops in Area 4	0	9	1.94	2.269	1.0
Total Stops in Area 5	0	3	.39	.712	0.0
Total Stops in Area 6	0	4	1.07	1.257	1.0
TOTAL	1	22	7.46	4.446	6.5

Figure 1: Total Time in Innovation Showcase (n=54)



Two different indices were calculated to describe visitors' time in the six exhibit areas relative to one another. The first, sweep rate index (SRI), shows a proportion of visitors' time spent in an area relative to its square footage. (An exceptional exhibition might have an SRI of 100,

while a typical exhibition has an SRI of about 300.) Based on mean visit time, Innovation Showcase had an SRI of 414. Calculating SRI for each of the six spatial / content areas shows variation within this overall proportion, however, highlighting which areas were more successful at retaining visitors. The SRI for each area was:

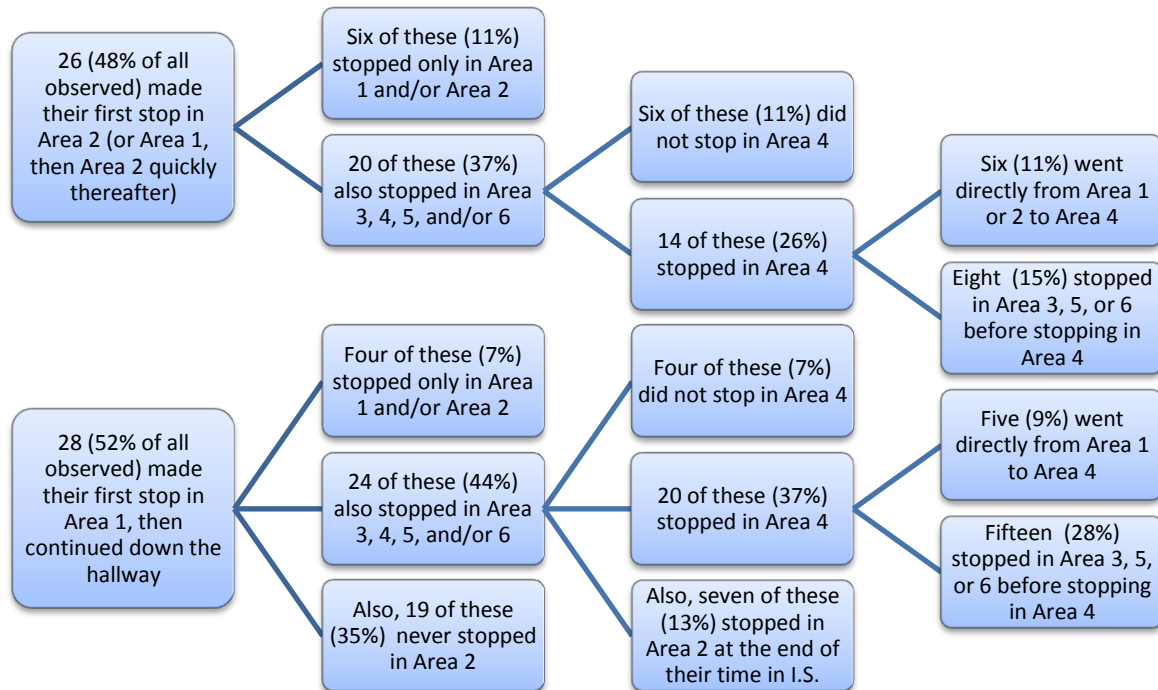
- Area 1: 391
- Area 2: 335
- Area 3: 676
- Area 4: 188
- Area 5: 521
- Area 6: 857

Another measure, the percent of diligent visitors (%DV) showed the proportion of observed visitors who stop at (or, in this case, pay attention to) more than half of the elements in an exhibition. (A “thoroughly used” exhibition might have a %DV of 50% or more, but this level of use is exceedingly rare.) Overall Innovation Showcase had a %DV of only 1.9%; this is reasonable given that many visitors spent time in only some parts of the gallery. Again, looking at the %DV of the six areas within Innovation Showcase drew out differences among them:

- Area 1: 13%
- Area 2: 35%
- Area 3: 11%
- Area 4: 44%
- Area 5: 6%
- Area 6: 0%

Finally, a path analysis showed how visitors flowed from one area of Innovation Showcase to another. Figure 2 describes the routes of the 54 visitors whose paths were observed.

Figure 2: Observed Paths Through Innovation Showcase (n=54)





Overall, nearly one in five visitors only stopped in areas 1 or 2, at the front of the hallway. About half of visitors began their visit in area 2, and half began by moving down the hallway. On the other hand, more than one third of visitors never entered area 2. Those who did enter that space tended to do so at the start of their path, rather than the end (30 vs. 7).

About half of those who began in area 2 (or one quarter overall) made it to the also-popular area 4 as well. More than two-thirds of those who did not start in area 2 (one third overall) also stopped in area 4. Overall, nearly two-thirds of all visitors stopped in area 4 at some point. Those who started down the hallway were far more likely to stop in other areas on their way to area 4 than those whose paths started in area 2 (8 of 14 in the former case, 15 of 20 in the latter).

Which elements or topics in Innovation Showcase were visitors using or attending to the most? The least?

Innovation Showcase included 26 exhibit elements; these panels contained some combination of text, media, artifacts, and / or interactives. Visitors were observed, in part, for four behaviors that indicated their attention to the various elements:

- Attending to (i.e., deliberately looking at) an element
- Pointing to (or calling another visitor's attention to) an element
- Using an element as intended (e.g., operating the alternative fuel pumps)
- Touching an element for some other purpose (e.g., making paper airplanes from take-away brochures).

A behavior was indicated for an observed visitor if he or she performed it one or more times per element, but only its presence or absence was recorded, not multiple instances of the same behavior at a single element.

Although interactive elements attracted the most attention behaviors from observed visitors, each of the different types of elements attracted a wide range of total attention behaviors. The mean number of attention behaviors per element for each type was:

- Interactives: 38.13 (std. dev. 11.72)
- Media: 13.00 (std. dev. 13.49)
- Artifacts: 12.40 (std. dev. 10.24)
- Text: 3.67 (std. dev. 2.45)

The large standard deviations for these averages demonstrated that visitors' attention varied widely within each type of element, but the differences in the means also showed that some types of elements were more successful than others at drawing attention overall.

Among individual elements, only one – an introductory text panel at the rear of the “Smart Grid” area – garnered no attention behaviors from the observed visitors. (See Appendix 1 for a description of all 26 elements.) All the others were used, touched, pointed at or attended to at

least once. The median number of attention behaviors per element across all observations was 8.5.³

Table 3 below lists the “top ten” of the 26 elements at which observed visitors demonstrated the most attention behaviors. This group of ten includes all eight elements that included a component which visitors could physically manipulate: both Energy Hog game stations, all four alternative fuel pumps, the thermal camera area, and the Boogie Board writing tablets. One artifact-focused element (the Energy Guide washing machines and coal) and one media-focused element (the green building touch screen) rounded out the top ten.

Table 3: Top Ten Elements by Total Attention Behaviors

Element Number	Element Type	Description	Total Attention Behaviors
2.4	Interactive	Thermal camera/Windows, and insulation /Home energy audit video (& text)	57
4.1	Interactive	Fuel pump: biodiesel (& text)	50
4.2	Interactive	Fuel pump: CNG (& text)	42
4.3	Interactive	Fuel pump: electric (& text)	39
1.3	Interactive	Energy Hogs game (2)	35
6.2	Interactive	Innovations in use: smart meter, tablets (& text)	33
2.1	Artifact	Energy guide washing machines (& text)	32
3.3	Media	Green building touch screen / samples (& text)	29
4.4	Interactive	Fuel pump: hydrogen (& text)	29
1.2	Interactive	Energy Hogs game (1)	20

Since “use as intended” was not always applicable for the text, media, or artifact-based elements, this “top ten” was also generated without considering those attention behaviors. This was done by calculating the proportion of behaviors noted at each element relative to “all possible” attention behaviors: 54 observed visitors x 4 behavior types (attend, point, touch, use) for interactive elements, and 54 x 3 behaviors (attend, point, touch) for all other elements.

³ This number describes the total number of attention behaviors observed at a given element across all 54 observed visitors.



This effort to control for the limited activity potential of some elements instead showed the stability of these ten elements' popularity. Table 4 shows the total behaviors, proportion of "all possible" behaviors, and the "top ten" ranking by each measure – the same ten elements are still ranked most highly and the top two elements overall, the thermal camera area and biodiesel pump, remain at the top. The shaded rows in this table highlight the only changes in rankings. The elements ranked 11th to 26th by count of attention behaviors also all remained in the same order when the proportional calculation was used.

Table 4: Top Ten Elements by Proportion & Total of Attention Behaviors

Element	Proportion	Rank by Proportion	Rank by Total	Total
2.4	26.39%	1	1	57
4.1	23.15%	2	2	50
2.1	19.75%	3	7	32
4.2	19.44%	4	3	42
4.3	18.06%	5	4	39
3.3	17.90%	6	8	29
1.3	16.20%	7	5	35
6.2	15.28%	8	6	33
4.4	13.43%	9	9	29
1.2	9.26%	10	10	20

What did visitors recall about their time in Innovation Showcase? Which visited elements were recalled the most? The least?

When asked to describe their time in Innovation Showcase, most interviewed visitors' recollections took the form of naming elements they saw or used. A few offered additional comments that indicated more complex engagement with or reflection about what they had seen and done. Appendix 3 shows all interviewed visitors' responses to this and other interview questions.

All six of the individuals who recalled something from their time in area 1 spoke about the energy hog games (elements 1.2 and 1.3). Three of these visitors expanded on naming the game by briefly describing its purpose (such as finding and eliminating "energy sinks") or something they remembered about it. No visitors recalled the introductory video (element 1.1).

Of the twelve visitors who recalled visiting elements in area 2, ten of them mentioned something about the thermal camera. Nine of these mentioned looking at or playing with the camera (element 2.4); the tenth said they enjoyed seeing "what the colors mean," but could

not elaborate further. Five individuals made comments about the washing machines and coal (element 2.1); all five connected these artifacts to one another, speaking about both how the coal translated into electricity for the washers and their understanding that the amounts of coal reflected each washer's energy consumption. No visitors recalled the light bulb or home energy use / outlet meter areas (elements 2.2 and 2.3).

Three of the four visitors who recalled something about visiting area 3 named artifacts or elements: looking at the POD home, seeing its insulation (element 3.2), or watching "some videos" (element 3.1) about it. The fourth spoke about how green building materials (element 3.3) caught their attention, noting that there were interesting technologies being used and that there were savings to be had for homeowners or consumers who used these items.

Fifteen interviewed visitors recalled something about the time they spent in area 4 – more than any other area of Innovation Showcase. Also, a greater proportion of these comments were more substantive than naming or description than comments about any other area. Most of these recollections were about the area in general, rather than any one individual element. Six individuals only noted seeing or playing with the pumps and / or fuels. The remainder had more specific recollections: some named the specific fuel types or how the different pumps worked; others mentioned differences between the fuels (such as their cost, the amount of emissions they generate, or their renewability). Three visitors each made an additional connection – one noted that information in area 4 related to ongoing research, one linked the alternative fuels to a broader energy conservation message, and one described what they saw in relation to their own experiences using a flex fuel vehicle.

Only one visitor recalled anything about area 5: having seen the "Buckeye Bullet" high-efficiency vehicle described as part of element 5.1. Neither of the career elements (5.2. and 5.3) were recalled by any interviewees.

Nine individuals recalled something about visiting area 6 of Innovation Showcase; six of these made comments about using or liking the Boogie Board writing tablets at element 6.2. Two described reading or noticing "smart grid" information, but did not elaborate, and two others reported seeing or reading "the Batelle information" in the BSIN hallway at the rear of the space. One visitor described looking at the electric meters and transmission wires that were part of elements 6.2 and 6.3; another, a student, described a specific interest in the smart meters because they had just written a paper about electric meters. No visitors made comments that specifically recalled elements 6.1 or 6.4-6.9.

As can be expected based on the strong correlation between the two variables described below, the elements recalled most often are similar to the "top ten list" of elements that prompted the most attention behaviors among observed visitors. (The only difference is that greater attention was paid to area 3's green building touch screen, whereas visitors more often recalled noticing the POD home in that area.)



To what extent did visitors recall the elements to which they attended?

Individuals who were interviewed were first asked to recall what they had just seen or done in the exhibition. The number of interviewees who stopped in each area, the number who were able to recall something about that area, and the percentage of those who both stopped in and recalled an area are shown in table 5 below.

Nearly all visitors who stopped in areas 2 or 4 were able to recall something about those areas; this is consistent with other indicators of these areas' strength described above. Area 1 inspired relatively less recollection than might be expected based on measurements of relatively high traffic and activity there. Conversely, interviewees recalled Area 6 relatively often, considering its lower levels of use than some other areas.

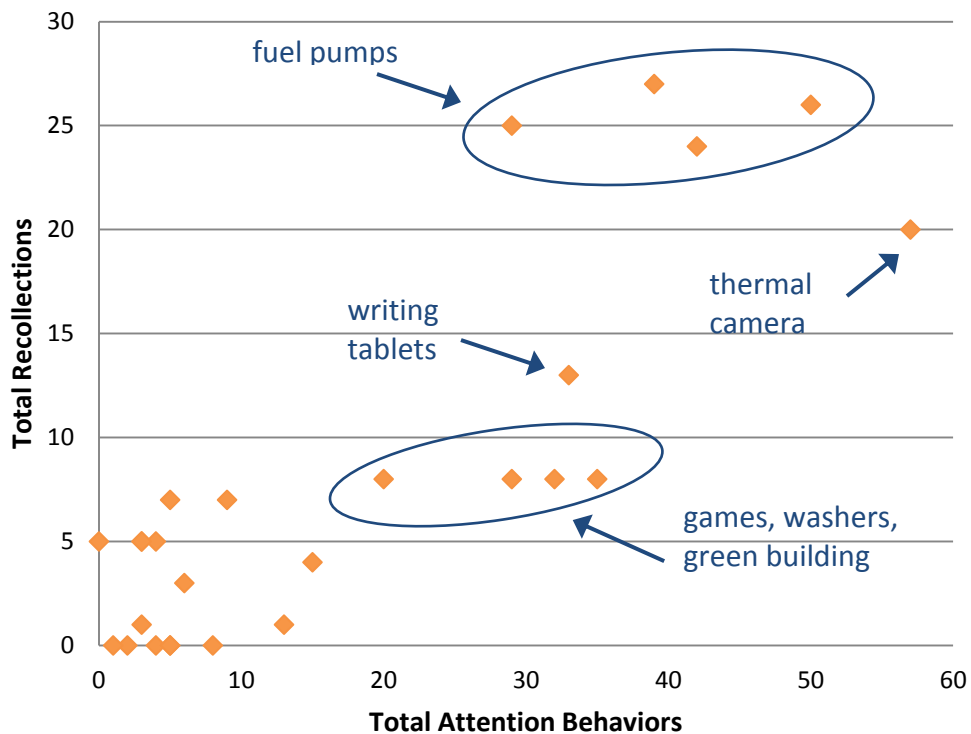
Table 5: Visitors Who Recalled Stopping in Each Area (n=25)

	Number who stopped	Number who recalled	Percentage of recollections
Area 1	20	6	30%
Area 2	15	12	80%
Area 3	12	5	42%
Area 4	18	15	83%
Area 5	9	1	11%
Area 6	13	10	77%

When considering the attention behaviors visitors displayed in relation to individual elements, a pattern emerged. Overall, the total attention behaviors demonstrated by observed visitors at an element has a strong, positive relationship with the number of times that element was recalled by interviewed visitors ($r=.839$).⁴ Just as the similarity between the “top ten lists” of attention-drawing elements most-recalled elements describes this relationship, so figure 3 illustrates it visually.

⁴ Since some visitor recollections were related to more than one element, “total recollections” in this calculation and figure were generated by combining recollections that were specific to an element with recollections that referred to an entire area or group of elements. The total recollections for the hydrogen fuel pump, for instance, include both specific mentions of that element and mentions of the fuel pumps in general.

Figure 3: Attention Behaviors at vs. Recollections of the 26 Elements



Communicating Exhibition Content

As with the initial recollection question described above, visitors offered a combination of both descriptive and explanatory comments across the exit interview as a whole. Discussion of these comments is based on COSI’s anticipated outcomes, as well as several additional categories of comments that emerged during analysis, follows.

How did visitors talk about their interactions with the various elements?

In addition to the outcome-indicating talk that COSI hoped to generate with Innovation Showcase, four types of comments emerged during analysis that are germane to the present evaluation questions:

- descriptive statements that noted particular elements or content within the exhibition
- statements about the personal relevance or connection an individual felt to some aspect of the exhibition
- statements that indicated either the interviewee’s awareness of potential action steps inspired by Innovation Showcase or their more explicit intention to undertake a related course of action



The most common of these categories was the descriptive statement. Instances of this reporting or fact-sharing talk occurred 37 times across the 25 interviews. The comments ranged from the type of naming comments that were responses to the first visit description question, through specific descriptions of exhibition content such as the savings possible for homeowners who request energy audits or the shape and weight of the hydrogen fuel nozzle.

The visitors who were interviewed also drew connections between what they had seen in the exhibition and their own lives; some, but not all, of these comments came in response to a question about what they might take away from Innovation Showcase to use after their visit. For instance, one visitor was interested in the coal shown in element 2.1 because “I used to have that washer,” while others were intrigued by the content about building materials in area 3 because of a desire to build their own green home someday.

During the exit interview, some visitors also made the leap from talking about Innovation Showcase to talking about behaviors that the exhibition might inspire. Twelve instances of talk that indicated an awareness of potential action or behavior change occurred. These comments often focused on the potential benefits (in terms of both personal savings and energy efficiency) of making personal changes: owning an electric car, buying efficient appliances, using efficient building materials, or reducing energy use in general. Two other individuals went further and indicated specific energy-related actions that they planned to take after their experience in Innovation Showcase: one noted plans to use more E85 in a flex fuel vehicle after learning more about its benefits over gasoline, and another was inspired to think about “how much energy we use” and how they planned to use different ways of measuring, thinking about, or changing that amount to reduce energy usage at home.

The fact that these different types of talk emerged from interviewees indicates that a number of the exhibition’s elements were entry points for visitors to connect their own experiences to the content of Innovation Showcase.

When asked about Innovation Showcase as a whole, did visitors articulate any of the key messages used by COSI?

COSI used six key messages in the early stages of development for Innovations in Energy. They were not necessarily specific to Innovation Showcase, as it was a phase of the larger project. COSI staff did not have an expectation that all or any of these key messages would emerge from speaking to visitors, but they wanted to identify which messages, if any, visitors took away from Innovation Showcase. A few key messages included two related ideas, so for purposes of analysis they were divided into eight statements. Table 6 shows these eight messages, and a count of the instances of visitor talk that related in some fashion to each message.

Table 6: Comments Related to Key Messages

Key Message	Number of Comments
The standard of living we enjoy today is made possible through the availability of affordable and reliable electric energy.	0
Energy systems today are complex and vast;	0
Energy systems aren't sustainable and need to improve.	3
There is no single solution to the challenges of meeting our energy needs;	1
Energy efficiency and conservation offer the most benefit in the shortest amount of time for the least effort and cost.	31
Everyone has a role to play and everyone makes choices.	28
Providing for our future energy needs creates career opportunities.	0
Providing for our future energy needs demands an informed citizenry.	0

Of these eight key messages, only two resonated strongly with interviewed visitors. Eighteen individuals offered a total of 31 comments related to energy efficiency and conservation as a main solution to energy challenges. These comments included a variety of reasoning: the personal savings and environmental benefit to be gained from reducing energy use, the importance of being aware of one's energy consumption, and energy efficiency as an end to be achieved using the tools and technologies shown in Innovation Showcase were all noted by one or more interviewees. Eighteen visitors also made a total of 28 comments which indicated the resonance of the "everyone makes choices" message. Some of these instances reflected actions the interviewees noted that they could do or planned to do, as described above. Others indicated choices that "people" more generally could make, often related to decreasing energy use or increasing efficiency; and still others articulated the presence of options (as with noting the multiple alternative fuels) that showed an opportunity to make choices.

Visitors did not seem to grasp the messages that pertained to energy systems in general or to their own potential roles as innovators or citizens, rather than as consumers. The strength of these two particular messages, however, shows that many visitors viewed themselves as able to make an impact on the future of energy systems from within that consumer role. This is encouraging in relation to COSI's attitude- and behavior-related outcomes for Innovation Showcase.

At any point(s) during interviews, did visitor talk indicate any of the short term outcomes desired by COSI?

As with the key messages described above, COSI's anticipated outcomes for Innovation Showcase took the form of seven statements which have been divided into nine units for purposes of analysis. The presence of talk related to these outcomes followed similar patterns seen in analyzing the interviews for both key messages and other emerging categories. Table 7



shows the nine outcome statements and a count of the instances of visitor comments related to each.

Table 7: Comments Related to Outcome Statements

Outcome Statement	Number of Comments
Know why our current rate of energy use is not sustainable;	0
Know what innovations are being planned.	22
Know that making sustainable energy efficiency and conservation choices improves quality of life in the long term.	26
Know the role of R&D & scientific innovators in solving complex energy challenges over time.	1
Feel inspired by energy innovators;	0
Recognize my own role as an energy innovator.	0
Feel inspired by innovative technologies;	2
Feel inspired by / to the choice to use them to benefit my life, pocketbook and the planet.	4
Use critical thinking skills (interpret, analyze, evaluate, infer, explain, self-regulate) to explore energy issues.	19

The most common outcome-related comments focused on knowledge about the benefit of energy efficiency and conservation choices. Sixteen visitors made 26 comments related to this outcome; many of these were also coded as indicating the efficiency-related key message above. However, this group omits talk about efficiency that was solely descriptive in nature (e.g., talk about one’s own potential cost savings through energy conservation was counted here, whereas a mention of energy conservation without elaboration was not). Next most common were comments indicating interviewees’ knowledge of planned innovations – fourteen individuals made 22 such comments. This talk sometimes occurred as part of the descriptive or information-reporting comments described above, but mentions of specific innovations continued through, and became more prevalent during, discussions of take-away information and messages individuals took from Innovation Showcase. The most commonly mentioned innovations had to do with motor vehicles and fuels, but new technologies related to home building, efficient appliances, and smart grid innovations were also mentioned (along with statements about advancing technology more generally).

In addition, twelve interviewees made a total of 19 comments that indicated one or more critical thinking skills were in play during their visit to Innovation Showcase. These comments were often instances where visitors went “beyond” COSI’s knowledge and attitude outcomes to ask questions or make connections that were not necessarily explicit in the exhibition itself. Several interviewees described exhibition elements in ways that showed they had evaluated the options presented in order to identify a “best choice” (or better choice) for their own

situations: the person who planned to use more E85 fuel, for instance, or the individual who saw value in adopting smart grid technologies in their own home.

Such instances of visitors going “beyond” what they noticed in the exhibition or seeking more from it (both in response to the interview questions and by way of individuals’ concluding comments or suggestions) may provide fruitful avenues for future development of Innovations in Energy.

Audience and Exhibition Feel

Who visits Innovation Showcase? To what extent did the actual audience(s) reflect COSI’s target audiences for the exhibition?

Taken in aggregate, the visitors who were observed and / or interviewed for this evaluation included the audiences that COSI wishes to reach with Innovation Showcase. However, many groups that fell outside these intended audience categories also visited the space.

While there were both children and adults in the observed groups, the children overall were younger than the target audiences for Innovation Showcase. Of 54 observed groups, 16 (29.6%) included one or more children who appeared to be over the age of eight. Two groups (3.7%) included children who appeared to be middle or high school-aged. One group included both age ranges, so a total of 17 groups (31.5%) included a child between the ages of eight and 18. An additional 20 groups (37%) included only one or more younger children; the remaining 17 groups (31.5%) were comprised of only adults.

It should be noted that adults who described themselves or others as an audience for Innovation Showcase did not use the intended “bill payer” label. Instead some perceived a “homeowner” target audience, based on the specific artifacts and examples presented in the exhibition. Several non-homeowner respondents noted this difference when describing ideas they might otherwise take away from the exhibition: they described feeling that they could not (or not yet) use much of the information presented in Innovation Showcase, because choices about major appliances, electric meters, insulation and the like were not necessarily within their control.

For whom did visitors feel Innovation Showcase was intended?

In exit interviews, visitors were asked to describe the age range(s) of people for whom they thought Innovation Showcase was intended. Respondents generally identified audiences that reflect COSI’s goals for the exhibition – reaching adult bill payers, children over the age of eight, and middle and high school age children. The answers to this question fell quite evenly into three categories.



Some felt it was a space for adults, and explained this view in terms of the content being presented: they indicated that “drivers and homeowners” might have both the greatest interest in and ability to use information related to energy consumption.

Others identified children or teens as a primary audience. Though some included children as young as five in their estimates (“as long as they can read” the exhibit text), all of the interviewees who identified children or youth as an audience included one or more of COSI’s targeted age ranges. No respondents described Innovation Showcase as a place for school groups, and no school groups were observed using the space during data collection.

A final set of interviewees described Innovation Showcase as targeting both adults and children. Like other respondents, these individuals tended to explain the exhibition’s content as being adult-focused and its interactive elements as child-focused. As one respondent put it, adult visitors “who can use or have experience with things like cars” may connect to Innovation Showcase’s familiar energy-related concerns, but they do so alongside children, for whom the space might be “arousing inquisitiveness” about the same topics.

How did visitors describe Innovation Showcase when comparing it to the rest of COSI?

Interviewed visitors’ thoughts varied when asked if Innovation Showcase looked or felt similar to or different from the rest of COSI in any way; in fact, equal numbers of people gave each response. Those who saw similarities described seeing them in Innovation Showcase’s hands-on elements and brightly colored design elements, as well as its focus on current, informative science content. Those who described the exhibition as different also noted its bright colors, but described it as less hands-on or interactive than other areas of COSI. For several people, the presence of “more stuff on the walls” and less “light and movement” made it feel like a somewhat quieter space for somewhat older visitors.

Conclusions & Discussion

Visitors' attention to elements:

How did visitors move through Innovation Showcase?

Visits to Innovation Showcase were relatively short, but not surprisingly so given the size of the space. Hold times varied dramatically from one area to another within the exhibition. Overall, areas 1, 2, and 4 were stopped in more often, visited for more time, and more thoroughly used. Visit paths began either to the right or moving forward down the hall, and there were differences in where visitors moved after these starting points.

Which elements or topics were they using or attending to the most? The least?

The elements that included some interactive aspect garnered the most attention behaviors from visitors overall. However, one media-focused element (the green building touch screen) and one artifact-focused element (the washing machines and coal) were also among the “top ten” elements.

The distribution of attention behaviors across the 26 elements remained stable even when accounting for limited options for “use” among the non-interactive elements.

What did visitors recall about their time in Innovation Showcase? Which visited elements were recalled the most? The least?

The following elements were most frequently recalled:

- Fuel pumps (recalled by 15 visitors)
- Thermal camera (10 visitors)
- Energy Hog games (6 visitors)
- Boogie Board tablets (6 visitors)
- Washing machines and coal (5 visitors)
- POD home and information (3 visitors)

These most-recalled elements align closely with the “top ten list” of elements that prompted the most attention behaviors among observed visitors. (The only difference is that greater attention was paid to area 3’s green building touch screen, whereas visitors more often recalled noticing the POD home in that area.)

Several other elements – the green building touch screen (element 3.1), Buckeye Bullet (5.1), smart meters (6.2), transmission lines (6.3), and smart grid information in general – were recalled by one or two visitors. Most of the elements in areas 5 and 6, as well as the introductory video (1.1) and text-based elements in area 2 (2.2 and 2.3) were not recalled by any visitors who were interviewed.

To what extent did visitors recall the elements to which they attended?

The proportions of visitors who were observed stopping in part of Innovation Showcase and who later recalled something about that area varied widely across the six areas of the gallery.



Comparing element-to-element, however, there was a strong, positive relationship between attention behaviors and later recollection of individual elements. This mathematical relationship echoes the parallel “top ten lists” described above.

Communication of exhibition content:

How did visitors talk about their interactions with the various elements?

Nearly all interviewed visitors were able to share at least one descriptive statement about what they had seen during their visit. About 60% also talked about some part of Innovation Showcase in terms of a particular personal interest or connection they felt to one or more elements or ideas. Nearly half also made at least one behavior-related comment, demonstrating either an awareness of potential actions one might take related to energy use (ten individuals) or specific plans for action they would take (two individuals).

When asked about Innovation Showcase as a whole, did visitors articulate any of the key messages used by COSI?

Nearly three in four visitors made comments related to each of two key messages:

- Energy efficiency and conservation offer the most benefit in the shortest amount of time for the least effort and cost
- Everyone has a role to play and everyone makes choices

The remaining key messages developed by COSI garnered little or no related talk during interviews.

At any point(s) during interviews, did visitor talk indicate any of the short term outcomes desired by COSI?

Interviewee comments related to Innovation Showcase’s outcomes followed similar patterns as analysis for the exhibition’s key messages and types of visitor talk. Talk which related to or indicated the exhibition’s outcomes clustered around three different statements:

- Know that making sustainable energy efficiency and conservation choices improves quality of life in the long term (16 individuals / 26 comments)
- Know what innovations are being planned (14 individuals / 22 comments)
- Use critical thinking skills (interpret, analyze, evaluate, infer, explain, self-regulate) to explore energy issues (12 individuals / 19 comments)

The prevalence of comments related to these three outcomes reinforces findings from elsewhere in this evaluation: most visitors to Innovation Showcase came away with an awareness of their role as consumers in shaping (i.e., reducing) energy use, as well as an awareness of tools that can be used toward that end. But a fair number of visitors also brought more to their experience than what they saw in the gallery, by comparing, connecting, and explaining the content in a variety of ways.

Target audiences and feel of exhibition:

Who visits Innovation Showcase? To what extent did the actual audience(s) reflect COSI's target audiences for the exhibition?

The visitors observed and interviewed in Innovation Showcase include members of all of COSI's target audiences. However, the sample was by no means comprised entirely of these audiences. About one-third of groups included the target audiences of older children or teens; another third included children who appeared to be under the age of eight; the remaining third were groups comprised of only adults.

Middle and high school students were also a target audience of this exhibition; no such groups were observed in the space during data collection.

For whom did visitors feel Innovation Showcase was intended?

Overall, interviewees perceived the exhibition as serving a combination of children – typically, older children in COSI's targeted age ranges – and adults. In general, they described the content of Innovation Showcase as appealing to (or being intended to reach) adults, while the interactive elements and design of the space were for children. The “bill payer” audience articulated by COSI, however, was not articulated by visitors; instead, some individuals perceived that a “homeowner” audience was targeted.

How did visitors describe Innovation Showcase when comparing it to the rest of COSI?

There was no consensus. Some interviewed visitors perceived it to be bright, interactive and informative, similarly to other parts of COSI. Others described it as being somewhat less hands-on, with “more stuff on the walls,” and a bit quieter and out-of-the-way. These mixed reactions point to COSI's success in balancing Innovation Showcase in order to serve older children and adults without being inaccessible or unfamiliar to more “typical” visitors with younger children.

Other visitor comments and suggestions

Several interviewees posed questions or made comments that, while not necessarily aligned to the present evaluation questions, offer additional insight into how visitors used the Innovation Showcase space and what their expectations of such an exhibition may be. If nothing else, these singular observations pose questions COSI may wish to consider in the next phases of Innovations in Energy. Each of the comments described here also appears in the full listing of visitor comments in Appendix 3.

When asked for additional comments, some spoke about the gallery space where Innovation Showcase was located. A few described it as being somewhat out of the way (even hidden) and one even felt the lack of traffic decreased the exhibition's effectiveness. Another had design suggestions for the space: that such a long gallery needs “something eye-catching” both at the front and the rear in order to promote visitors' circulation through the space, for instance. The



ways in which content was presented also drew comment. One visitor described their hesitation to use the videos because it was impossible to skim or select from them for information without viewing the entire piece. Conversely, another individual noted disappointment at how much text there was in Innovation Showcase – these mixed reactions echo the mixed perceptions people had of the exhibition’s intended audiences.

Some interviewees also posed suggestions or challenges to the content of Innovation Showcase. One specifically suggested the inclusion of wind energy, while several others noted the focus on non-renewable energy sources in their responses to interview questions. Others described leaving Innovation Showcase with questions of their own – “what fuels do to the environment,” for example, seemed to one person like it should be a part of the exhibition’s discussion of fuels. Another visitor wanted more process information, giving the example of wondering how coal becomes electricity which then powers the washing machines in area 2, or other examples of how fuels and / or energy are produced. These questions show that at least some COSI visitors are ready for a more system-level view of energy use and related issues.

Intriguing questions

In a preliminary discussion of findings with COSI team members, a number of additional questions and ideas arose that were beyond the scope of this evaluation. The following ideas piqued the group’s interest, and may be fruitful avenues for future study during later iterations of Innovations in Energy or at COSI more generally.

- What are some strategies for smoothing the distinction Innovation Showcase visitors made between the “bill payer” and “home owner” audiences? Are some artifacts or examples more broadly applicable, or more easily layered, than others?
- What are the best strategies to maximize visitors’ circulation to the back of the current Innovation Showcase space? Do they mostly have to do with element placement, content presentation, or a combination?
- The washing machines in area 2 reminded team members that artifacts are most powerful when they “tell a story” and create context to which visitors relate – even when well-situated artifacts seemed to be “competing” for visitors’ attention with more interactive elements or media, they still resonated with some individuals.
- COSI staff noted a range of different reactions and behaviors around the games and writing tablets as compared to other media. What are the characteristics of an interactive technology that attracts visitors to the device itself, and what characteristics make an interactive technology a good vehicle for communicating exhibition content?
- The present evaluation has not answered the team’s questions about *why* visitors might be drawn to certain elements or articulating certain messages or outcomes. However, these findings can still inform both decision-making for the next iteration of Innovations in Energy and which questions might be asked in future formative evaluations.

 March 12, 2012

Appendices

Appendix 1: List of Innovation Showcase Elements

Area 1	1.1	Media	Introductory video
	1.2	Interactive	Energy Hogs game (1)
	1.3	Interactive	Energy Hogs game (2)
Area 2	2.1	Artifact	Energy guide washing machines (& text)
	2.2	Text	Home energy use / reduction (text)
	2.3	Text	Light Bulbs (not on floor - text)
	2.4	Interactive	Thermal camera / Lights & windows / Insulation / Home energy audit video (& text)
Area 3	3.1	Media	POD home video (& text)
	3.2	Artifact	POD home materials (samples & text)
	3.3	Media	Green building touch screen (& samples & text)
Area 4	4.1	Interactive	Fuel pump: biodiesel (& text)
	4.2	Interactive	Fuel pump: CNG (& text)
	4.3	Interactive	Fuel pump: electric (& text)
	4.4	Interactive	Fuel pump: hydrogen (& text)
Area 5	5.1	Media	Alternative fuels video / touch screen (& text)
	5.2	Media	Careers touch screen (& text)
	5.3	Text	Careers brochures
Area 6	6.1	Artifact	Home energy manager (touch screen) & smart meter text
	6.2	Interactive	Innovations in use: smart meters, tablets (& text)
	6.3	Artifact	Transmission lines (& text)
	6.4	Text	Innovations in distribution & transmission (text)
	6.5	Text	Energy generation (text)
	6.6	Text	Innovations in generation (text)
	6.7	Text	Power lines (image)
	6.8	Text	Innovations introduction A (text)
	6.9	Text	Innovations introduction B (text)

Appendix 3: Interview Questions and Responses

Area 1 Description

- woman: "I played the game"
- played the game
- purpose of the game was to whack the energy hogs before they used up all the hot water
- played [game] in the kitchen, learned about energy star
- the games: "that's all we did"
- just played the game; described it as being about finding and eliminating "energy sinks"

Area 2 Description

- looked at the camera
- thermal imaging camera was cool
- heat thing
- "played with the thermal camera"
- big orange window caught their attention: thought [what's behind] it would be interesting - their draw was the glass, but "kids probably like the camera"
- seeing how much coal [for the washers] was kind of interesting
- kids played with "heat camera"; "I looked at the coal and energy and saw something about kilowatts"
- "the thermal camera was cool" [prompted about area 2]
- talked about the washers and the amount of coal each used; looked at the heat sensor
- woman: was interested in seeing the amounts of coal; boy: liked the camera, seeing / learning "what the colors mean"
- liked the "heat sensor"; seeing the amount of coal that translates into amount of electricity was interesting (caught eye because "I used to have that washer"), shows need to decrease [energy] use
- heat camera

Area 3 Description

- "watched some videos"
- was interesting: the savings to be had, the technology being used
- looked at the POD home
- thought it was cool, saw the insulation



Area 4 Description

- "played with the gasoline pumps"
- played with the gas
- followed child; talked about "what I do with the car" as child played with 3 of 4 pumps; read some information
- were awesome / fun
- the gas - "that's where all our money goes"
- saw different kinds of gas; it's getting awareness out about different types of fuel; noted the different costs [i.e., \$ per gallon] of each one
- related to motor vehicles; showed alternative fuels, including electric and biodiesel; noticed it included information on related research
- played with the pumps, saw what gas cost
- boy likes pumping things
- boy noted there were different kinds of fuels, and they all had different prices; connected alternative fuels to conservation of resources
- "I made [my group] all come look at the smart fuels"; noted the hydrogen & natural gas handles were very heavy & would be hard for some people to use; noted the price difference for fuels, but also different fueling speeds
- gas tanks: one has to give them money; there were different fuels, 1 made of corn was biofuel, another was electric; boy pretended it was his own car, with the goal of spending the most money; woman noticed it was difficult to latch the electric plug; woman read the biofuel because she has a flex fuel vehicle, noted the relative emissions / burning speed / MPG of E85 vs. regular gas
- saw different fuels
- "played with the gas pumps"
- gasolines: there were different fuels shown; talked about how they are / aren't renewable

Area 5 Description

- saw the Buckeye Bullet

Area 6 Description

- wrote on writing boards
- "the meters caught me" - student who just wrote a paper on electric meters, wanted to see what it said about them
- liked the tablets
- reading about smart grid; also noted BSIN space
- played with the tablets

- wrote on the boards, but didn't read or pay attention to the content; did name it as the "smart grid" area [but could maybe see titles during interview?]
- looked at the electric meters and wires [said had a limited visit today, but recently "did everything" in the I.S. space]
- b: played with the tablets; M: "I read the Batelle information" in the BSIN hallway
- b liked the tablets

Question about what interviewees will take away from Innovation Showcase

- nothing useful right now: not homeowners; noted things for the future: efficient fuels for a future car, energy efficient building materials
- yes: after reading the comparison, will pump more E85 - taking away what's familiar & relatable
- liked the idea of the smart grid, would like to implement it at home
- savings possible through using energy audits, smart grid; mentioned there's a benefit to these things both for individual consumers and the nation
- mentioned the drawback of heavy pump handles, especially for older drivers - will remember that
- the information on "how much energy we use" - and ways of measuring, thinking about, and changing the amount; will use this information to reduce usage at home
- a reminder that looking at the energy efficiency of appliances is important; didn't know before about the different fuels and "where they're headed" re: development; b: "I like being environmentally friendly [which means] being more natural to the earth and using less resources"
- recycled & efficient home building was interesting: would like to build their own, more green house someday
- never saw a heat camera before
- the pod home is interesting - sparks curiosity; more of the information would be applicable if owned a home
- liked the game: it teaches 6th grade science content
- the electric pump was really light and easy to use; there were comparisons of the types of fuel; stuff for the house (e.g. insulation, etc.) "we kind of know already" but was interesting to see
- the fuels: likes the hydrogen idea, but in general "alternative fuels really interest me"
- electric cars: could save you some money, would be cool to have one; discussion of the pollution / emissions for each fuel type
- that there are many remedies [for "energy sinks"]: fixing / replacing fridges, windows, etc.



- the smart grid: if had one available, could use it to monitor spending & energy use
- things to use in the future / when we have a house: information from the camera, the floors of the POD house; looked at fuels and saw that the cheapest was also the least renewable

Question about main messages of Innovation Showcase

- encouraging people to do things like turn off lights - in order to save money, help the environment
- efficiency: using resources smarter so we have them; noted focus on what's renewable
- area 2: conservation [of energy]; area 4: alternative fuels
- show new developments and innovations in the energy sector; show the importance of energy conservation to individuals and the nation
- describing current alternative energy development; encouraging (but not "preachy") to think about how much energy you're using
- be more aware of resources; use less energy and do things to conserve
- be more energy efficient; making people "aware of stuff that's out there" / new developments
- awareness of energy consumption; alternative energy use
- be careful how much energy you use
- "go green" and help the environment; energy efficiency lessons
- had a lot about emissions and alternative technologies; helps people to see what could be coming
- show different energy options; show energy saving appliances
- alternative energies & sources
- energy & ways to conserve it - effective "if you read it"
- energy efficiency; trying to be gentler to the environment
- innovation; conservation of energy
- energy efficiency; sustainability
- remodel homes to be greener; be "energy conscious"

Question about Innovation Showcase's intended audiences

Adults

- adults more than kids
- "our age group" - high school, college, and people going into careers: kids are too young to understand, older generation is too set in its ways, we're able & willing to change [our behavior]
- more for adults and older kids (10-12) - g is 10; especially for "drivers and homeowners"

- young adults (mid 20s); not for kids: kids don't know or care about things like gas, insulation, etc.
- for "the younger crowd" (20s-30s); not kids because "kids don't drive"
- adults, "I don't see too many kids reading or caring about sustainability"

Children

- older kids or teens
- kids 8-12: they need the ability to understand things like temperatures
- late elementary audience: barrier to getting the information is reading, but one b (about 6?) understood ideas of the game when W read him the instructions
- teenagers: they're old enough to have content catch their attention and read it; "little kids would probably like the fuel pumps"
- "as long as they can read" - kids 5-12
- kids 7-15 [didn't describe why]
- 12 or 15 & up, kids but not adults

Both

- good on an adult level, the "touchy stuff" [hands on] is more for kids
- more for adults, who can use or have experience with things like cars; but also for children: gives them some idea of the topic, "arousing inquisitiveness"
- parents and kids together: has stuff for kids (the gas pumps) and for adults (the house-related information)
- for everybody, ages 6-adult: "lots of adults don't know this stuff, either"; "we [W & b] talk a lot about it" at home
- content is for adults; games and activities are for kids: kindergarten at least; fuel pumps keep everybody busy
- 6-14 for activities ("a little kid-ish"); 18+ for the information (a little hard for kids, but adults will get it)
- understanding-wise, more for adults - gas buyers 16+; but good for getting kids introduced to those ideas

Question about the similar or different feel of Innovation Showcase in relation to COSI

Similar (8/16):

- no reasons why
- feels like the other hallway exhibits "all over" COSI
- the same hands-on stuff
- it's informative
- it fits with the rest of the science stuff
- haven't seen much, but feel about the same
- hands on, same bright colors
- reminds of little kidspace: the space feels newer, the ideas feel newer (more current), as opposed to "1970s" information in Space, for example



Different (8/16):

- not quite as interactive as other exhibits
- a lot smaller space
- the other spaces are just informative, but this one is informative AND preachy
- it's orange
- definitely more reading & less hands on, "more stuff on the walls"
- feels older (in terms of content and setup / target audience) than other spaces
- the color sets it apart
- not as "extreme" as other spaces (like Ocean) in terms of light & movement (asked "less kinetic?" "Yes")

Request for other comments or suggestions

- add wind energy
- add more explanation (how electricity comes from coal, how other fuels are made)
- add more on what fuels do to the environment
- wouldn't have seen the space if not from mezzanine stairs
- really liked the hands on parts, but never stopped to watch or listen to the videos - would rather read to pick out just the information they want, rather than waiting to watch all of something
- needs something eye-catching up front, but also something big at the back to draw people through the space
- lack of traffic decreases effectiveness
- conveys ideas well except that there's more descriptive text than activities