Delivering the Nuclear Promise
Top Innovative Practice

December 11, 2023

DNP-TIP-2023–12

3D Virtual Nuclear Plant Tour
2023 Top Innovative Practice Winner[1]

Summary

Xcel Energy created an immersive virtual tour of the Prairie Island plant and made it available to the public via the Internet. The virtual tour gives visitors an unprecedented level of access and understanding of the inner workings of a nuclear power plant. The tour is both visually stunning and interactive, giving visitors the power to choose the parts of the plant they wish to explore. The tour is accessible anytime, anywhere, from any Internet connected device.

Innovation

A nuclear power plant is a remarkable sight. To see one up close leaves a lasting, positive impression. Nuclear professionals know this well but have always faced physical and practical limitations to sharing such an experience with individuals not on plant staff. With the 3D virtual tour of its Prairie Island plant, Xcel Energy has pioneered an immersive, interactive experience that is replicable across the industry. It offers an effective and affordable model to significantly expand visibility of, and familiarity with, nuclear power facilities. It is a tool capable of markedly improving stakeholder and decision-maker opinions on nuclear energy's presence in their communities. It has already generated a 450% return (based on the cost of developing the virtual tour compared to the cost of hosting in-person tours).

A matter of trust: Challenges spotlight the opportunities

Nuclear energy has been quietly proving itself as an increasingly valuable part of the world's energy mix for decades. Resilient in the face of extreme temperatures. Reliable across weeks, months and years as other resources have been shown to fail in times of need. Carbon-free by its very nature, and more affordable by the year as the industry continually drives toward excellence in operations. These facts are not well understood by the public. At the same time, communities across the U.S. and the world are making multi-decade decisions on their energy infrastructure and community and industrial leaders are increasingly drawn to the promise of nuclear energy projects. Billions of investment dollars hinge on their decisions. These leaders must maintain their constituents' trust while also providing confidence to investors and stakeholders that the community will welcome those nuclear investments. Education of the public about nuclear power is becoming ever more important.

[1] Winning entries of from NEI's Top Innovative Practices (TIP) awards are republished as DNP Efficiency Opportunities to ensure the broadest possible dissemination of these operating plant innovations.

While nuclear energy is increasingly regarded by experts as an essential part of the global energy mix in the near and long term, it has battled negative public perceptions for decades. More concerning is that nuclear energy is greeted by most of the public with a sense of apathy. According to Bisconti Research[2], approximately 60% of those polled have no strong opinion. And those without a strong opinion are the most easily influenced.

Experience has proven that operating nuclear plants benefit from familiarity. Communities surrounding nuclear power plants overwhelmingly approve of them. Plant operators, and those who interact with the public on their behalf, point to the ability to show off their plant in-person as the single-most effective means of instilling public trust. Seeing helps with believing.

Providing in-person tours of nuclear plants is a challenging and costly endeavor. Most often, operating plants cannot host the number of visitors they wish to. The security response to the September 11th attacks closed off much of the general public's access to the nation's nuclear facilities. The COVID-19 pandemic shut out visitors entirely from many sites. Bringing people to the plant for public tours has always been costly, requiring staffing, coordination, and security processing. Further, there are limitations to group size, and it can be hard for some individuals to navigate a site in person.

That is why Xcel Energy has brought the plant to the people with a 3D virtual tour. In some ways it is an unsurpassed experience. It is a truly interactive and empowering experience. The virtual visitor chooses what to visit next and how long to stay there. The virtual tour is guided, but flexible. It can be accessed anywhere, anytime, from a smart phone or a computer. It is an easy, instant, and familiar experience. Not so different from exploring a new town in Google Maps.

Results

- To date the virtual tour has not been heavily promoted. Most results have come from organically driven traffic from a small number of social media posts. There is potential for far more substantial traffic once promoted with targeted social media spend.
- Visits: 4,200
- Cumulative time spent: 200 hours
- Average time spent: 3 minutes per visit
- Global reach: Visitors from 40 countries
- Tour hot spots: Turbine deck (10% of overall traffic); Reactor core (9% of overall traffic). Viewers have spent the most time viewing the key plant components such as the core, generator, and reactor head.
- Impact on public perception: While no direct impact can be measured, it is yet another example of innovation at Xcel Energy and in the nuclear business unit. Access, visibility, and transparency are central to building trust and demystifying the technology.
- Ingenuity in action: Nearly 80% of the 3D imagery was already in-hand and became a repurposed use of content developed for internal training tools. Many of the featurettes (embedded videoes) were drawn from previously created media or presentation materials.

Safety

The tour is valuable both as proof-of-concept and stand-alone product. These are some of the many sources of value the virtual tour represents:

[2] https://www.bisconti.com/blog/public-opinion-2023

- Immersive. In a matter of seconds, one can "fly" over a nuclear power plant, venture into containment and peer directly into the core of the reactor. That is a unique experience. Tour visitors are then invited to explore with 360-degree views, and to click to hear or see more.

- Flexibility. It began as, and remains, an extension of the site's tour program. An alternative experience when the company could not offer an in-person tour, it now serves as a resource for schools, multi-media content for Xcel Energy's digital channels, and a novelty for employees who are now able to show their families more of their workplace than ever. Further, a streamlined version is a new emergency preparedness resource and crisis communications tool. It is also used as the foundation for plant worker training to help familiarize contractors or plant workers preparing to visit bump-sensitive or unfamiliar areas of the plant.

- Extensibility. This product is effectively a prototype. It can be easily updated, modified, or extended to fit emerging needs or newly available multimedia.

- Unique messaging vehicle. If a user spends even one minute with the fly-in introduction, they have learned about the key role nuclear energy will play in Xcel Energy's future and how critical the plant is to the community and Xcel customers. One more minute guides the user to a "how nuclear works" video. By minutes 4 or 5, they have seen key plant components and can begin to appreciate how impressive a nuclear plant really is.

- Contextual. It offers a straightforward way to get a sense for the limited footprint of a site, how clean and orderly it is inside and out, and how it operates in harmony with nature. One may notice that the Independent Spent Fuel Storage Installation is quite small. Visitors will see some of the external security features that provide a sense of impenetrability.

- Safe. An in-person tour carries with it inherent safety risks. Not only are there the typical industrial safety concerns associated with navigating a facility like a nuclear power plant, but there are also additional radiation exposure risks, depending on the tour. This option provides the visibility gained by visiting a site without the physical safety hazards that come along with it. It simply creates an opportunity to see the innermost workings of the plant that very few would ever be allowed or qualified to visit in-person.

Costs

Quantified costs: $2199 (incremental spend)

- Web hosting: $500
- Software: $499
- Camera: $500
- Voiceover: $700
- Labor: $0. This was a level-of-effort project, with no incremental labor dollars spent. However, an equivalent of roughly 150 hours was spent on developing the tour itself, spread across multiple individuals over several months as time allowed.
- 3DVista[3] was the vendor for both the software and web hosting services.

Savings/Benefits

Replacement value of tours (# tours x # tour prep hours):

- Two hundred hours of virtual tour time implies the equivalent of 40 tours (five visitors on a two-hour tour).
- Each tour requires about 20 hours of staff time in preparations and hosting. That implies 800 hours of equivalent staff time.

[3] https://www.3dvista.com/en/

- That indicates a net 450% return on labor (800 hours saved against 150 hours spent) with substantial upside yet to be realized as the asset is further leveraged with minimal maintenance costs.
- Advertisement value of exposure is not easily calculated, but exposure generated by organically driven social media can be conservatively valued in the tens of thousands of dollars.

Transferability

- Emergency preparedness: Xcel Energy has created a version of the plant tour that is ready-made to assist in plant response and public communications in the event of an emergency. This version strips away the branding, voice over and value messaging to provide a strictly visual tool that is vastly more effective in viewing the plant than any tool previously available. It provides quick and seamless access to both internal and external views and provides unsurpassed context for the viewer unfamiliar with the plant or the technology in general.
- Internal: Monticello, Prairie Island's sister plant in Minnesota, will benefit significantly from the learnings obtained from developing the Prairie Island tour. A 50%-time savings is expected in creating a Monticello virtual tour. Xcel Energy also intends to generate this sort of interactive feature with other assets it owns and operates to tell its clean energy story more visually.
- Industry-wide: With the concept now readily available for imitation and iteration, and Xcel Energy's openness to sharing experiential learnings with peers, the barriers to further transferability are exceedingly low. Note, however, that each individual plant will need to apply all applicable review standards for making content public. Xcel Energy conducted both security and Part 810 export rule reviews.

Team Members

- Jeff Dehn, Manager - Communications Strategy and Performance
- Dave Tombers, Senior Communications Consultant
- Chris Lee, Senior Innovation Engineering Analyst
- Todd Hurrle, Director Nuclear Fleet Operations - Innovation
- Margie Church, Communications Consultant

Additional Information

Figure 1: Screenshot of the exhilarating fly-in introduction to the Prairie Island 3D Tour

Figure 2: Tour experience – navigation

Figure 3: Tour experience – reactor core

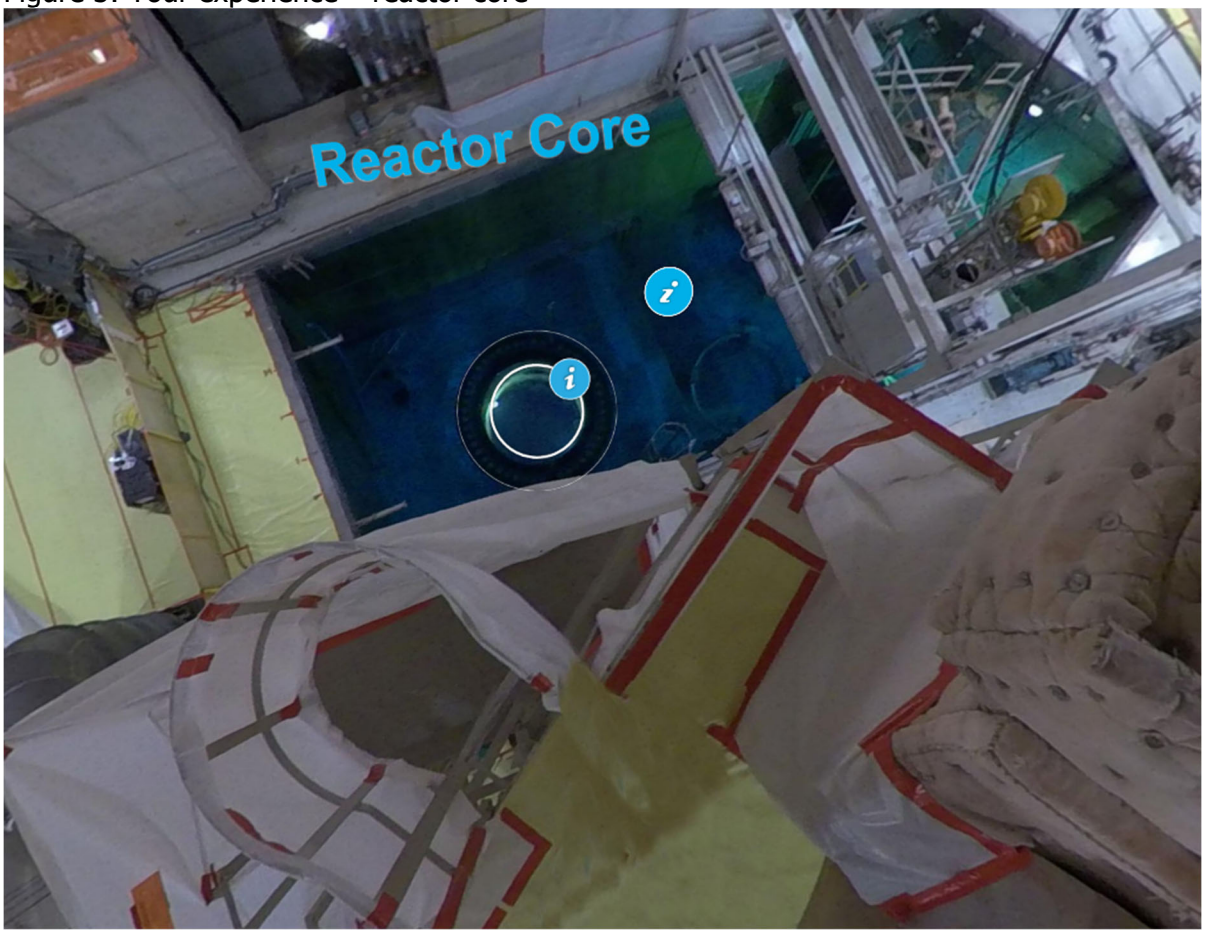


Figure 4: What has driven traffic to the 3D tour site

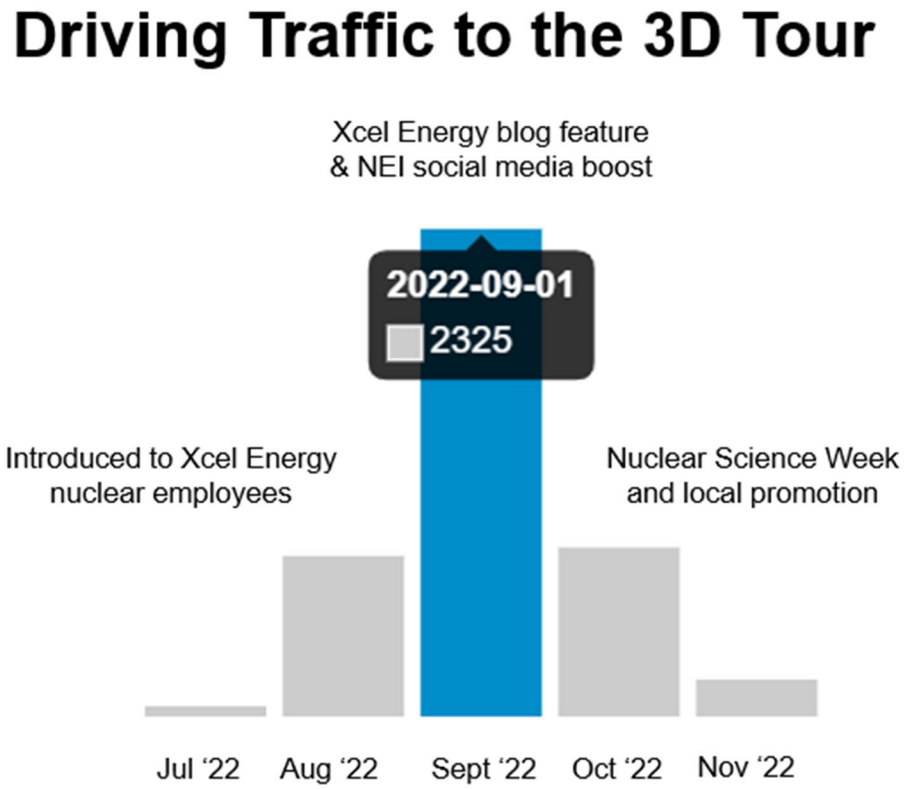
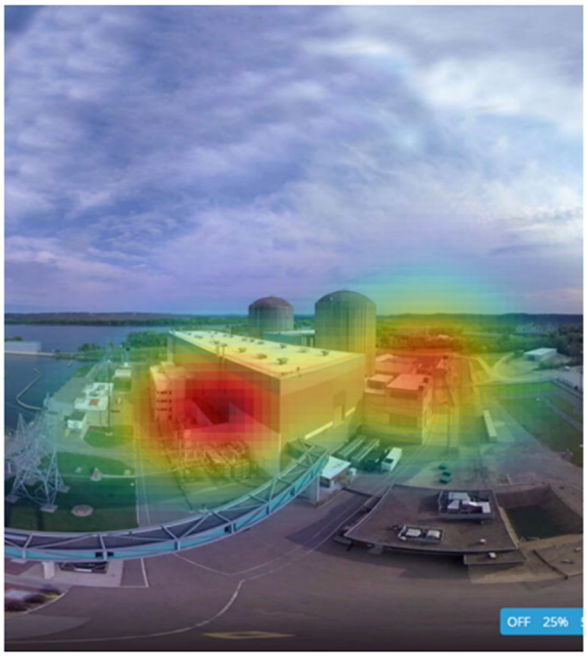


Figure 5: Tour traffic analytics: heat map and media traffic metrics – more time spent at key components



Medias

Media	Percentage	Views	Time
Aerial View (Plant Ent...	18.0%	3623	0:00:23
End of Tour. Thank Y...	10.3%	2083	0:00:14
Turbine Deck	9.2%	1858	0:00:18
Reactor Core	8.7%	1752	0:00:48
album_2E502273_3C...	5.4%	1084	0:00:00
Emergency Diesel Ge...	4.5%	904	0:00:19
Aerial (Cooling Towers)	3.7%	752	0:00:22
Moisture Seperator ...	3.7%	743	0:00:19
Generator	3.3%	665	0:00:54
Reactor Coolant Pum...	3.3%	658	0:02:50
Reactor Head	3.2%	639	0:01:06