THIRD WAY

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Nuclear Reimagined

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Advanced nuclear technologies can propel the world toward our climate goals by providing affordable, zero-carbon electricity and heat; supporting the growth of renewable energy sources; and supplying clean energy for water desalination, hydrogen production, and other processes that will be vital in creating a low-carbon economy.

But a picture is worth a thousand words. Despite the huge impact advanced reactors could have on climate efforts when they start hitting the market in less than a decade, we have few images to help us understand where and how they'll fit into our communities.

That's why Third Way partnered with the distinguished sustainable design team in Gensler's Washington, DC office to visually tell the story of advanced nuclear and put its potential into perspective. These architectural sketches and renderings explain the important roles that advanced reactors will play

in a variety of energy systems. And the innovative designs of new reactors allowed us to show nuclear energy integrated into communities like never before.

Advanced nuclear is on the horizon. Now, we have a better sense of what we can look forward to.

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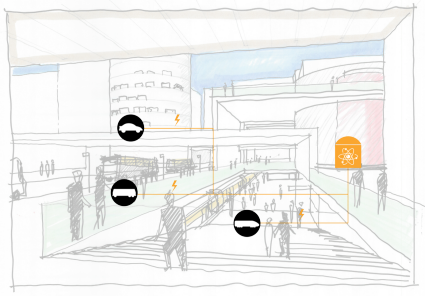
“Remote Arctic Community” scenario:

As mayor of one of the 200 Alaskan communities with no connection to a power grid or natural gas pipeline, you understand how your way of life depends on shipments of fossil fuels to run your generators and heat your buildings. Your town pays dearly for it, too. With electricity prices up to 16 times higher than the U.S. average, energy costs can gobble up half the income of poorer households. You’re probably also worried about what you’d do if fuel supplies run low during a long winter and how many weeks you might have to wait for iced-over shipping routes to reopen before you could restock. Then there’s the health concern posed by dirty diesel fumes, not to mention the climate damages like sea level rise, erosion, and changes in wildlife migration that fossil fuel use is already inflicting in your part of the world.

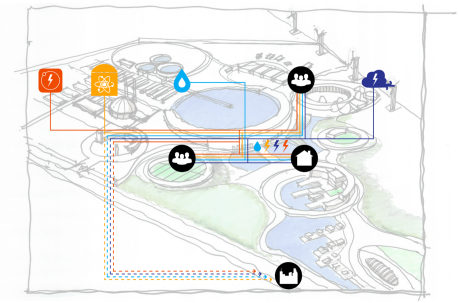
Arctic communities like this one are beginning to explore advanced nuclear reactors as a solution to their unique energy challenges. Some of the reactors currently in development are under two megawatts in size —small enough to fit the needs of a remote town with less than 1,000 residents. Instead of using inefficient diesel generators, these “micro reactors” could be connected to a community grid and provide emissions-free power at a fraction of the cost. Many advanced reactor designs also produce heat and steam that could be used in homes and public buildings, and they could even support new industries like agriculture or food processing. And because they can operate for years before they need to be refueled, advanced reactors would allow isolated communities to be more self-sustaining and less reliant on each shipment of fossil fuels.



“Clean Transit Hub” scenario:

On the surface, your morning commute is going to look pretty similar 20 years from now—you’ll still see a combination of cars, buses, and trains on roads and rails. But some less-visible trends might be upgrading your trip by that point. You still won’t have that flying car, but you could be tackling your inbox from the backseat of a driverless one. If it drops you off at a transit center like the one pictured here, you might find that bus and train systems are easier to connect to and plan the rest of your trip around. And each leg of your commute could be relying more on clean sources of energy and less on dirty fossil fuels. That’s a big one. With transportation now the largest source of greenhouse gases in the U.S., we’ll need to eliminate most of the sector’s emissions if we want a shot at hitting our climate targets. So of all potential trends in commuting, the shift toward clean energy is one that absolutely must catch on.

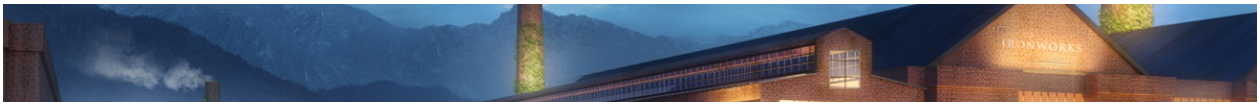
The backbone of this clean transit hub is a small modular reactor that provides zero-emissions power to charge the personal electric vehicles in the “park and ride” garages, the shared autonomous vehicles waiting to pick up passengers arriving on the commuter train, and the fleet of buses stored at a nearby depot every night. This same reactor is also used to power the entire rail line, in addition to a corridor of EV charging stations along the adjacent highway. And during the quiet late-night hours, the plant can put its unused capacity toward hydrogen generation at a nearby truck stop for big rigs that will have a harder time switching over to batteries when they ditch dirty diesel.



“Catalyst for Clean Growth” scenario:

Your experience living in energy poverty doesn’t look the way people in wealthier nations imagine. You don’t share an isolated village with a few dozen neighbors. You share a crowded and sprawling city with thousands or even millions of people. Your dream isn’t to have a portable solar panel that lets you charge your phone or run a couple light bulbs. What you really need is for the power grid in your neighborhood to function more than a few hours a day—you need it to provide enough reliable and affordable energy to encourage the growth of local industries and jobs and to genuinely improve your family’s quality of life. Communities like yours in the developing world will see populations surge in the coming decades, and their demand for energy and energy-intensive resources like clean water will rise even faster. Meeting their needs without spiking CO2 emissions will be critical to global climate efforts.

This desert compound is pumping out much-needed carbon-free energy. Central to its operations is a large, advanced reactor with over 1,000 megawatts of capacity that supplies most of the power used by a growing city 25 miles to the east. The reactor is mostly underground, which is an efficient way to help meet rigorous standards for security and safety. The simplified design cuts down on cost and construction time, while also providing more flexibility to ramp production up and down in cooperation with the city’s increasingly popular rooftop solar installations. Any excess capacity is put to use powering an onsite desalination plant that provides the city with treated water from a brackish underground aquifer, as well as a hydrogen production facility that gives local factories a carbon-free source of heat to make the steel, cement, and fertilizer that are driving economic development. In addition to clean resources, this complex supports hundreds of well-paying jobs, offers on-site housing options for workers, and provides community and recreation spaces for the public.



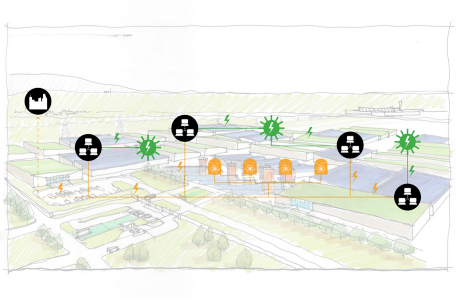
“High Temperature Reactor for Industry” scenario:

Living in an old industrial town in rural America, you’re familiar with how quickly things change with new waves of technology. The digital revolution and advances in shipping and transport have already ramped up international competition for the anchoring employer in your area, a chemical processing plant that’s powered by fossil fuels. Now, pressure to cut down on greenhouse gas emissions has often left you feeling trapped between economic and climate change concerns—why should you have to choose between preserving the environment and protecting the jobs of your friends and family?

With the next wave of technology change, maybe you won’t have to. Most people know that electricity generation and transportation contribute heavily to America’s greenhouse gas problem—but a fifth of our total emissions stem from industrial processes. These industries provide products that are absolutely necessary for a modern economy. They also employ ten percent of American workers. So simply getting rid of them isn’t a realistic option for decarbonization. Renewables can help supply a plant with low-carbon electricity, but they’re not great at producing high temperature heat required by many industries. The high temperature reactor in this scenario is providing the electricity and the 700 degree heat needed for a chemical processing facility, and it could supply heat to other factories within a reasonable distance. These reactors could be configured and scaled to fit in a vacant industrial facility like this one or could even be installed within the footprint of a struggling or retired coal plant, making use of existing buildings, grid connections, and even the local labor force.

“Naval Base” scenario:

As the Commanding Officer of a naval installation, you are intimately familiar with nuclear energy as an efficient and reliable power source—it’s the primary driver for the Navy’s submarines and aircraft carriers. This is not the case for the rest of your base’s operations, though. You rely on the civilian grid for electricity, but your facility is too important for national security to allow any interruptions from a standard power outage. That means you have to maintain a large fleet of diesel generators for backup and keep enormous amounts of fuel onsite to avoid supply interruptions. Meanwhile, your heavy use of fossil fuels is contributing to globally destabilizing forces like climate change, making your mission even harder. Realizing the flaws and challenges of its current energy strategy, the Navy is aiming to meet half its shore-based energy requirements with alternative sources and get 50% of bases to have net-zero emissions by 2020—and it’s your responsibility to make it happen at your facility. With an advanced reactor onsite, Navy and other military bases could generate enough electricity around-the-clock to run all of their facilities and power ships docked at port. With its own microgrid and the ability to run a reactor for years between re-fuelings, a base wouldn’t be vulnerable to power outages that regularly impact the rest of the grid. In fact, this reactor could provide emergency power to local hospitals and other critical infrastructure in the event of a weather-related disaster, a fuel shortage, or any other interruption. The Navy helped pioneer the first wave of nuclear reactors. Half a century later, it could be one of the biggest beneficiaries of this new generation of nuclear technology.



“Data Center” scenario:

Every day, you check your phone—what, three or four dozen times? From listening to Spotify to navigating with Google Maps to watching Netflix while on the treadmill, we all constantly consume

enormous amounts of data. All of that data has to come from Internet servers, and those servers need a lot of power—to the tune of 70 billion kilowatt-hours per year, or 1.8% of America's energy consumption. Tech-focused companies are racing to build new data facilities to keep pace with rapidly growing consumption—the average smartphone owner will use nearly 500% more data in 2021 than in 2014. Because so many parts of our lives are now dependent on uninterrupted digital service, these energy solutions need to be extremely reliable. And to make the challenge even more complicated, some of the biggest tech companies are trying to drastically expand their services while meeting public commitments to shrink or eliminate their carbon footprint.

Enter advanced nuclear reactors. One or multiple reactor units could completely power a data center whether it requires 2 MW or 200 MW (as some of the biggest might). Even better, they could do it at a competitive cost while producing zero emissions. Data centers like the one pictured here can be pre-sited to accommodate additional reactors as the center grows in size and capacity requirements. And these reactors provide extremely reliable, consistent energy. The ability to run data centers with years of fuel onsite—compared to, say, diesel generators that involve shipping fuel to the facility—decreases the number of variables center managers have to take into account when ensuring adequate power supply and reduces the use of highly-polluting backup generators.

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