

► to the top of the US political agenda with a sustained campaign that included public demonstrations at the White House.

“Rejecting the pipeline makes it tougher to dig up tar sands that would only add more fossil fuels to the fire,” said Lou Leonard, vice-president for climate change at the conservation group WWF in Washington DC, in a statement. “We hope it continues the momentum we’re seeing to ratchet up climate ambition for Paris and beyond.”

Republican lawmakers have argued just as vociferously in favour of the pipeline, accusing environmentalists of trying to kill jobs and drive up energy prices. Keystone XL vaulted into the US presidential campaign agenda in 2012, and its spectre will haunt next year’s race to pick Obama’s successor. Several Republican presidential candidates quickly vowed to reverse Obama’s decision on the pipeline if given the chance.

“When I’m president, Keystone will be approved, and President Obama’s backwards energy policies will come to an end,” tweeted Republican contender Marco Rubio, a Senator from Florida.

Obama addressed his critics head on in his White House speech, arguing that there is no economic justification for approving Keystone XL. Oil production in the United States is at its highest level in years, he said, and oil prices have fallen sharply. Obama also

noted that the US economy is growing even as greenhouse-gas emissions decline — due in part to his administration’s regulations for curbing vehicle emissions of carbon dioxide.

Some industry analysts argue that the cancellation of Keystone XL will have a minimal impact on the tar sands’ overall greenhouse-gas output, however, because energy companies can merely ship their product to market by rail or through other pipeline projects that are already in the works.

“Keystone was a very prominent project given the symbolic nature it took on, but there are a lot of projects and options out there,” says James Burkhard, vice-president of the consultancy IHS Energy in Washington DC.

His firm estimates that oil production from the tar sands could increase by up to 25% by 2020 compared to the 2014 level, based on projects that are already approved and under construction. The price of oil exerts a strong influence over oil-sands investment, Burkhard says — but the cancellation of Keystone XL boosts uncertainty about tar-sands development after 2020.

And there is some evidence that this uncertainty is already having an effect: on 27 October,

energy giant Shell cancelled its Carmon Creek tar-sands extraction project, citing the difficulty of shipping Canadian oil to markets. The energy firm Statoil voiced similar concerns when it cancelled another tar-sands venture last year.

Shell is not abandoning Alberta altogether, however. Hours after Obama rejected the pipeline, the company formally launched a project to capture and store more than 1 million tonnes of CO₂ each year at an oil-processing plant in the province. But the Can\$1.35-billion (US\$1-billion) project relies heavily on subsidies, and there is as yet no plan to make such projects economically viable in the future, says Simon Dyer, regional director for Alberta at the Pembina Institute, an environmental think-tank in Calgary.

Dyer says that Obama’s decision on Keystone XL could help to reshape Canada’s climate policy. The country’s new prime minister, Justin Trudeau, is a supporter of Keystone XL who has also pledged to combat climate change. And Alberta’s new premier, Rachel Notley, plans to release parts of a climate policy for the province before the UN Paris meeting begins.

If Canada wants to develop markets for its oil, Dyer says, it has to create a credible climate policy and decide how much of its carbon budget should go to the tar sands. “This is an extremely controversial and polarizing thing to say in Canada,” Dyer says. “The conversation is long overdue.” ■

“Keystone was a very prominent project ... but there are a lot of projects and options out there.”

ASTRONOMY

Arecibo Observatory head quits after funding row

Departure of long-term advocate adds to the woes of the financially troubled radio telescope.

BY TRACI WATSON

Physicist Robert Kerr uses irony to describe the first hint of trouble: “Radio quiet,” he calls it. After four years as director of the Arecibo Observatory, home to the world’s largest single-dish radio telescope, he says that he was suddenly out of the loop: contacts at both the US National Science Foundation (NSF), which owns the observatory, and SRI International, the contractor that runs it, stopped returning his e-mails and phone calls.

After a month of silence, Kerr was stripped of his role as the observatory’s principal investigator. Shortly afterward, he resigned from his other post, as operations director.

Kerr traces his departure to a disagreement

over a possible windfall for the Puerto Rico observatory. In late July, he publicly criticized the NSF for planning to cut its contribution to Arecibo if the facility began to take payments for helping in a private survey looking for signs of extraterrestrial intelligence. NSF officials say that his assertions are inaccurate and that his communication with Kerr never lapsed.

Whatever the facts, some Arecibo observers see Kerr’s exit as an ill-timed loss for a storied, but financially threatened, scientific facility that faces a murky future.

“Somebody’s going to have to be the person actively trying to figure this out,” says Michael Nolan, a former Arecibo director now at the University of Arizona in Tucson. “Bob was that person. Without him, I don’t know what their plan is.”

The drama surrounding Kerr’s departure is in keeping with the scale of Arecibo, which has a bowl-shaped reflector that measures 305 metres across and is the world’s most sensitive radio telescope. At Arecibo, researchers made the first discovery of a binary pulsar — the 1974 find won a Nobel prize in 1993 — and of the first planets outside our Solar System.

Today, 52 years after it began operations, Arecibo is still one of the world’s go-to telescopes for getting a close look at potentially hazardous asteroids, and the facility remains a key tool for studying pulsars and Earth’s upper atmosphere.

But past glories and present capabilities may not ensure its survival. The NSF, which provides two-thirds of the observatory’s US\$12-million annual budget, is strapped for cash



The Arecibo Observatory in Puerto Rico is beset by budget problems.

to build and operate new telescopes that are high priorities for the astronomy community, such as the Large Synoptic Survey Telescope now under construction in Chile. In 2006, an expert panel recommended that the agency close Arecibo unless someone else could be found to foot the bill. NASA began kicking in with money five years ago and now contributes \$3.7 million annually, but so far no one has materialized to pay the rest.

Meanwhile, the NSF faces pressure to keep grant money flowing while it funds new telescopes. A 2012 expert report warned that unless the NSF slashes the amount it spends on large facilities such as Arecibo, research grants to astronomers could be “decimated”.

An avowed Arecibo champion, Kerr was the observatory’s on-site director from 2007 to 2008 and returned in 2011, taking up the roles of both operations director and principal investigator. During his tenure, proposals for the use of Arecibo rose, he says, and a system for studying the ionosphere with high-frequency

radio waves was rebuilt. Even so, budget cuts forced the lay-off of some 20% of the staff a decade ago. The facility is afflicted with “stagnation”, says radio astronomer Alex Wolszczan at Pennsylvania State University in University Park, who in 1991 used Arecibo to make the first detection of extrasolar planets.

Kerr, an upper-atmosphere physicist, made the best of a difficult and frustrating job, colleagues and users say. “Bob really cared about the observatory, and he really wanted to find a way to make it work,” says University of Arizona planetary scientist Ellen Howell. She and her husband Michael Nolan were researchers at Arecibo until this summer.

About that time, a potential Arecibo saviour appeared in the form of Russian billionaire Yuri Milner. Milner’s Breakthrough Listen project is funding a \$100-million effort to search for intelligent extraterrestrial life, and wanted to enlist Arecibo’s help.

In Kerr’s telling, NSF officials told him that if Arecibo got funding from Breakthrough, its

own funding would fall by the same amount. In a 29 July article, an angry Kerr told the magazine *Scientific American* that the NSF had placed Arecibo in an “unscrupulous” bind: walk away from the Breakthrough money, or accept it and lose NSF dollars.

But NSF officials say that it was not like that. “It was expected that some offset would occur because this situation would divert telescope time” away from other science, says NSF astronomy-division director Jim Ulvestad. But the agency has still not decided whether Breakthrough funding would trigger a one-for-one cut or indeed any cut at all, he says. Kerr and SRI were both told so repeatedly, Ulvestad says.

COMMUNICATION BREAKDOWN

It was after the *Scientific American* article appeared, Kerr says, that communication with his superiors at SRI and with NSF officials ceased almost entirely. He got an e-mail notice a month later that he was no longer Arecibo’s principal investigator and, feeling hamstrung, decided to step down from the operations director’s job as well. He does not regret speaking out, but “I certainly regret that I’m no longer a primary advocate for the observatory”.

The NSF says that communication with Kerr continued as usual, and Kerr concedes that his regular biweekly phone calls with the agency did not end. The NSF referred other questions about Kerr’s tenure to his former employer, SRI, which says that it does not discuss matters of personnel.

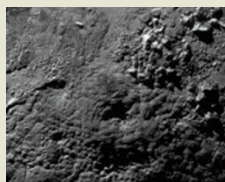
Just after Kerr cleared his desk, the NSF appealed in a ‘Dear colleague’ letter for proposals to run the observatory, calling especially for ideas that “involve a substantially reduced funding commitment from NSF”. The agency says that it is now reviewing whether it will continue to support the facility. Kerr, who worked to find private parties to manage and fund the observatory, says he remains hopeful that a coalition of universities and foundations will emerge to rescue Arecibo.

But others are less optimistic. Efforts to find an outside donor have been ongoing for some time, to no avail, Nolan says. Users can be expected to pay for telescope time, but “someone has to pay for the base operations — keeping the grass cut, keeping the big steel structure from falling out of the sky”, he says. “And that’s the part everyone’s finding too expensive.” ■ [SEE EDITORIAL P.134](#)

JAY M. PASACHOFF/SCIENCE FACTION/CORBIS


**MORE
ONLINE**

TOP STORY



Icy volcanoes may dot Pluto’s surface
go.nature.com/xqvouy

MORE NEWS

- Psychologists’ betting market hints at most reliable research findings
go.nature.com/sjhp19
- Light and heat propel bendy graphene crawlers
go.nature.com/nw3uez
- A glaciologist’s account of life in Antarctica
go.nature.com/twfl5s

NATURE PODCAST



Sexism in science on Twitter; porous liquids; and the relationship between humans and bees nature.com/nature/podcast

NASA/JHUAPL/SWRI