Arctic during the IGY. In the last decade alone, many of those stations have fallen silent, depriving meteorologists of key data on temperature and rainfall, for example. According to the Russian Academy of Sciences, only 45 polar hydrometeorological stations were functioning in 2002, a two-thirds reduction over the past decade. Refurbishing the stations is a top priority, says Eduard Sarukhanian, WMO's IPY coordinator. However, adds Rapley, "what we're keen to do is make sure that doesn't just focus on meteorology and hydrology but opens up new vistas on other research—from any field that people can convince us is worthwhile."

Opening new vistas may well be the driving theme of the IPY. "There are subglacial lakes and the spreading ridges under the Arctic that have never been explored," Bell says. And while biologists have barely begun to catalog life in polar oceans, there are hints that here, too, the frozen ends of Earth have a global influence.

One theory suggests that the Southern Ocean might have been a source of much of the biodiversity in the deep oceans worldwide. When the Antarctic continent broke away on its own, a girdle of swift-moving ocean currents formed around it, trapping species in the chilly waters of the Southern Ocean and forcing them to adapt to extreme conditions, Rapley explains. Those creatures, then, may have hitched a ride to other oceans. Brigitte Hilbig of Ruhr University in Bochum, Germany, recently identified several worms in 5000-meter-deep waters off Angola that are nearly identical to one first identified in the Southern Ocean, 5000 kilometers away, suggesting that there may be important connections between the life forms of polar oceans and seabed habitats worldwide. To probe this further, Hilbig and colleagues have proposed taking a zoological and genetic census of the Southern Ocean as part of the IPY.

The Arctic waters, too, likely hold new surprises. An expedition in 2001 to the Gakkel Ridge, where the continental plates bearing Europe and North America are spreading apart, turned up much more hydrothermal activity than scientists expected, says Jörn Thiede of the Alfred Wegener Institute for Polar and Marine Research in Bremerhaven, Germany. As part of the IPY, he and his colleagues hope to send a remote-controlled sub to survey the region.

IPY organizers also hope to attract interest from astronomers who can use polar summers for uninterrupted views of the sun; medical researchers who study human responses to extreme conditions; and social and political scientists who could study the impact of Arctic warming on northern Russia, Canada, and other Arctic Rim nations.

In an initial call, organizers received nearly 150 proposals. "It's taking off like gangbusters," Rapley says. The ICSU committee and its partners will settle on a handful of flagship projects by autumn, he says. (Contributions are still welcome; see Editorial, p. 1437.) Rapley says that ICSU might try to coordinate three to five large-scale efforts, such as major transects across the poles or large-scale atmospheric or ocean surveys. He hopes the effort will inspire a wellspring of multinational projects around the globe organized by other scientists.

It's not yet clear whether such efforts will add up to the $1 billion infusion the last IGY enjoyed. Karl Erb, director of the U.S. National Science Foundation's Office of Polar Programs, estimates that NSF might contribute up to $50 million in research funding and logistical support for IPY-specific activities, from its nearly $400 million annual budget. Given the formidable base that the field is building on, a smaller investment than that plowed into IGY could have just as profound an impact, argues Chad Dick of the Norwegian Polar Institute in Tromsø, Norway. The onus will be on organizers to choose projects with far-reaching payoffs. "If all we do is have a blast for 2 years and nothing changes in our ability to monitor the poles for the long term, we will have failed," he says. Considering the track record of the first two IPYs and the IGY, failure would appear to be only a remote possibility.

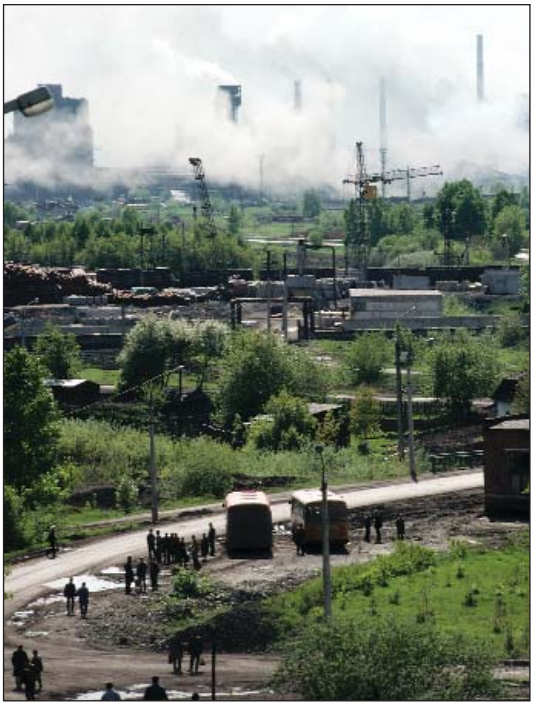
–RICHARD STONE AND GRETCHEN VOGEL

Climate Change

A Eurasian Tiger Threatens To Maul Kyoto

A new U.N. report is likely to strengthen the case of hard-liners intent on ditching Russia's commitment to ratifying the climate treaty

Two years after the United Nations began putting the heat on Russia to ratify the Kyoto Protocol, enthusiasm in Moscow for the global plan to tackle climate change has cooled rapidly. In recent months, senior Russian government officials have repeatedly challenged U.N. greenhouse gas forecasts suggesting that Russia would benefit from a key treaty sweetener, the sale of billions of dollars' worth of emissions credits. Now Moscow's Kyoto doubters are about to get a boost from a surprising source: the U.N. itself. According to a draft report for the secretariat of the U.N. Framework Convention on Climate Change in Bonn, Germany, the data underlying the U.N.'s emissions forecasts for Russia are full of holes and out-of-date. "It's a problem in general with the U.N. estimates," says Kremlin economist Peter Kaznacheev. "They tend to base their estimates on old data."



Back to the future? Coal mines and steel mills belch greenhouse gases in the southern Siberian city of Novokuznetsk.

CREDIT: PETER TURNLEY/CORBIS

The future of the Kyoto Protocol is in Russia's hands. For the treaty to come into force, it must be ratified by countries whose greenhouse gas emissions total more than 55% of global output in 1990. With the world's biggest greenhouse gas emitter, the United States, having renounced the treaty, Russia is crucial to slipping over the 55% bar.

For a while, things were looking up for Kyoto backers: Russia had long signaled its intention to ratify the treaty. Its carbon emissions plummeted in the 1990s as decrepit Soviet-era plants and factories

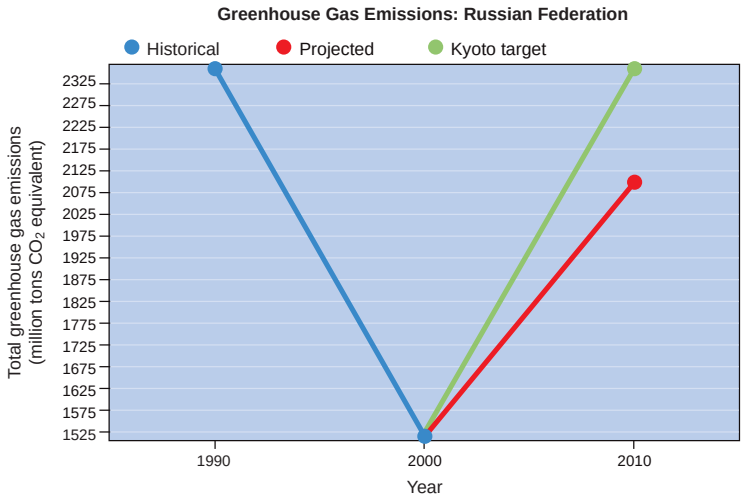
ground to a halt. But a rip-roaring economy of late has prompted some Kremlin insiders to claim that Russia may not have any carbon credits to sell in 2008, when the Kyoto treaty is supposed to come into force. Indeed, they warn, Russia may end up having to cut back on fossil fuel consumption to stay below 1990 emissions levels, as Kyoto requires.

One of the more outspoken adherents of this view, Andrei Illarionov, Russia's presidential adviser on economic issues, last week compared the Kyoto Protocol to the notoriously unrealistic Five-Year Plans imposed by Soviet authorities. Speaking to a forum of European Union officials lobbying Moscow to ratify the treaty, Illarionov drew an unflattering parallel between what he calls "Kyotism" and Marxism: "During the 20th century, Russia seriously suffered from another ideology that came from Europe," he mused. "Not only Russia, but the whole world suffered."

With the treaty's fate hanging in the balance, researchers on both sides of the debate have been scouring Russia's emissions data for ammunition to better press their case. Russia's third national communication, mandated by the climate change convention, would appear to support the Kyoto cause. It notes that Russia's greenhouse gas emissions—not counting perturbations from land-use changes—declined 38% in the decade following the dissolution of the Soviet Union, from 3 million metric tons of "carbon dioxide equivalent" in 1990 to 1.9 million metric tons in 1999. Moreover, the third communication, submitted to the U.N. in November 2002, predicts that greenhouse gas emissions would not surpass 1990 levels before 2015. That backs U.N. forecasts made in 2000 that Russian emissions would remain 20% below 1990 levels through 2012 (see graph).

The new review for the U.N.'s climate change secretariat casts doubt on those scenarios. Russia's third communication does not include emissions data from important energy sources, notes the draft report, prepared by a team that included experts from Spain, Hungary, Ecuador, and the International Energy Agency. One major shortcoming is Russia's failure to account for the potential impact of its plans to almost double coal production by 2020. "We questioned whether emissions would not increase more than they are saying [they would]," says one analyst who has seen the report. And due to insufficient funding, the report says, emissions from waste incineration, aviation, and many other industries were not evaluated. Another weakness is that the third communication contains emissions data only through 1999. Since then, the U.N. reviewers note, Russia's economic growth of 6.5% per year on average suggests upward pressure on greenhouse gas emissions.

Russian and U.N. officials declined to respond in detail before the review is released later this month or early in April. But the Russian government has acknowledged deficits in its emissions reporting and has begun to improve its data collection, notes deputy foreign minister Yuri Fedotov.



Simplistic views? Some Kremlin officials have rejected U.N. forecasts that Russian emissions will be well below the Kyoto target—1990 emissions levels—in 2010.

The coordinator of the U.N.'s 2000 emissions forecasts for Russia, Nebojsa Nakicenovic, an economist at the International Institute for Applied Systems Analysis in Laxenburg, Austria, acknowledges that Russian emissions could exceed Kyoto limits earlier than predicted late in the next decade. But he doubts that Russia can sustain its current rate of economic growth. Nakicenovic also argues that the rate of growth of emissions will begin to tail off to about half the economic growth rate if Russia follows through with long-awaited investments in energy efficiency. "Russia is not likely to exceed Kyoto limits even if its economy doubles during the next 10 years," Nakicenovic says, "and the doubling of the economy would indeed be an incredible achievement."

That assessment is shared by Alexander Golub, an emissions economist at the nonprofit organization Environmental Defense's Washington, D.C., office. In a study for the World Bank in 1999, Golub, one of Russia's representatives on the U.N.'s Intergovernmental Panel on Climate Change, was among the first to warn that solid economic growth without significant energy efficiency reforms might propel Russia beyond its Kyoto emissions limits far sooner than the U.N. had predicted. Now, however, Golub argues that a close analysis of energy usage suggests that the rate of growth of greenhouse emissions is not keeping pace with economic growth. That means Russian emissions will remain well within Kyoto limits, he claims.

The wild card, Golub says, is coal. He worries that if Russia more than doubles its coal output to feed domestic energy needs while exporting its natural gas, greenhouse gas emissions could skyrocket past Kyoto limits. Although Golub considers Russia highly unlikely to increase coal production so rapidly, Illarionov says that Russia intends to go full throttle in tapping coal reserves.

The new U.N. report, observers say, will play into the hands of Kyoto skeptics. In a speech in late January, Illarionov advocated rejecting Kyoto on the basis of studies by the Institute of Economic Analysis (IES) in Moscow, a think tank he headed before joining Russian President Vladimir Putin's staff. "We've got newer, better data indicating our actual emissions are much higher than the U.N. forecasted," says Kaznacheev, an economist on Illarionov's Kremlin team. The IES studies, Kaznacheev says, indicate that increases in Russia's greenhouse gas emissions have nearly matched the percentage increases of its economic growth since 1999, a trend that suggests Russia should surpass its 1990 emissions levels within 2 years after Kyoto is implemented in 2008.

The raw data that IES tapped are from a 2002 report from the U.S. Department of Energy's (DOE's) Energy Information Administration. The report states that Russian oil and coal production have been booming since 1999, with carbon emissions largely unchecked. "I don't really think they are willing to slow growth in that industry to head off environmental impacts," says David Correll, a Russia analyst at DOE Headquarters in Washington, D.C., who was involved in the DOE study. "We don't see those kinds of policy initiatives."

The bottom line, Kaznacheev says, is that Russian policymakers no longer see Kyoto as a cash cow. "It's unlikely Russia will make profits from carbon dioxide quota sales," he says. And meeting Kyoto targets is out of the question: The targets "are hardly affordable," says Kaznacheev. Russia's rising fortunes, therefore, could be the Kyoto treaty's ultimate misfortune. **–PAUL WEBSTER**

Paul Webster is a writer in Toronto, Canada.

SOURCE: UNEP/GRID

A Eurasian Tiger Threatens to Maul Kyoto

Paul Webster

Science **303** (5663), 1461-1462.
DOI: 10.1126/science.303.5663.1461