

Petitioner Russ Wade – PRO SE

BEFORE THE ENVIRONMENTAL APPEALS BOARD

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D.C.

_____)
 In re: Sierra Pacific Industries, Anderson Div.)
 _____)
 PSD Permit Modification SAC 12-01)
 PSD Permit 94-PO-18 (issued June 15, 1995))
 PSD Permit 94-VP-18b/d)
 _____)

Docket No. 14-03

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 ENVIR. APPEALS BOARD

Respondents: EPA Region 9 ("Region"),
Shasta County Air Quality Management District ("Shasta AQMD")

PETITION OF RUSS WADE

I hereby certify that this petition submitted by this statement of compliance and the attached Certificate of Service contains an estimate of 3,400 words.

Exhibits Attached:

Exhibit A - April 29, 2014 Redding Record Searchlight article "Sierra Pacific, EPA issues new permit, plant to expand to 31 megawatts"

Exhibit B - April 2014 National Geographic article "Can Coal Ever Be Clean? Carbon Capture and Storage (CCS), Disposing of waste CO2s"

Proposed Cogeneration Plant in Anderson is Bad For Our Nation's Air

I, Russ Wade, am writing to urge the Environmental Appeals Board ("Board") to accept jurisdiction and review this Prevention of Significant Deterioration ("PSD") permitting process.

I am concerned that this flawed PSD process will be considered acceptable. I fear it could become a national model for constructing future toxic factories that degrade our nation's air and water quality.

I am a stakeholder in the permitting of SAC 12-01, the proposed 31 megawatt ("MW") Sierra Pacific Industries ("SPI") cogeneration power plant, set to be located in Anderson, CA.

I attended the December 10, 2013 public hearing held by Region for the proposed "modification" of SPT's 4 MW sawmill with my wife, Joy. The road conditions were dangerous throughout the county. Many people were unable to attend, such as my friend Heidi Strand. The roads were completely impassable at higher elevations.

The number of the PSD permit that Region hopes to modify was kept secret at the December 10, 2013 public meeting I attended.

Region revealed the PSD permit number they want to "modify" when they issued their latest 31 MW PSD permit on April 25, 2014. This number was only given after the December 10, 2013 public hearing and after the entire process was over.

According to Region, the number of the PSD permit that SAC 12-01 will be "modifying" is 94-PO-18. Region disclosed this at the end of the permitting process, a violation of the Clean Air Act and Region's own PSD permitting program, as defined under 40 CFR §51.166.

Region failed to obey your court's orders because they held the December 10, 2013 public hearing on SAC 12-01 two weeks before Christmas, following a record storm. It snowed in San Francisco during this time period.

Currently, the same permitting action is on the Board's active docket in two separate places: PSD permit 94-PO-18 (renumbered 94-VP-18b) and PSD modification of 94-PO-18 (renumbered PSD SAC 12-01).

It seems that Region and Shasta County AQMD have created a permitting process so confusing that no statutes exist to justify it. Further, no regulations exist to explain it.

HISTORY OF FLAWED "MODIFICATION" PERMIT SAC 12-01 - Why the SPI cogeneration plant process is bad for our air quality.

In 1995, Shasta County AQMD issued SPI a PSD permit to build a 4 MW sawmill in Anderson, California: (PSD permit 94-PO-18).

According to representatives from Shasta County AQMD, the "PO" stands for "permit to operate."

In 1998, Shasta County AQMD rolled the PSD and Title V permits together and kept the number the same (94-PO-18).

Most likely, Shasta County AQMD did this to save time. Having one permit serve in place of two permits cuts down on staffing hours.

In 2003, Region revoked and rescinded Shasta County AQMD's authority to issue or modify PSD permits.

It appears Region later declined to do the paperwork required of a PSD permitting agency. After rescinding Shasta County AQMD's authority in 2003, Region erred in failing to do the paperwork on their own permitting process.

On September 20, 2006, Shasta County AQMD erroneously modified and renewed SPI's 4 MW sawmill's combined PSD/Title V permit. Shasta County AQMD lacked authority to issue or modify federal PSD permits in 2006.

At this time, Shasta County AQMD renamed the combined permit for the 4 MW sawmill (94-VP-18b).

According to representatives from Shasta County AQMD, the "V" is for "title V permit to operate" and the "P" stands for "PSD permit."

On July 3, 2009, Shasta County AQMD declared itself the lead agency for the proposed SPI (then only 21 MW) cogeneration power plant and released a Notice of Preparation ("NOP") and an initial study.

On September 12, 2012, Region released a public notice proposing to modify an unnamed PSD permit to allow SPI to build and operate a 31 MW power plant in Anderson, CA.

From early 2009 until April 11th, 2013, Shasta County AQMD, under Region's supervision, was trying to permit a new (then 21 MW) power plant without a PSD permit. By April 11, 2013 it had become a 31 MW power plant. Where was Region, the oversight agency?

On February 21, 2013, Region issued a new PSD permit (SAC 12-01). Mysteriously, without public knowledge, a modification of SPI's 4 MW sawmill became a brand new permit (SAC 12-01).

On April 11, 2013, Shasta County AQMD held a public hearing.

At the hearing, SPI representative Dave Brown asked Shasta County Air Pollution Control Officer Rick Simon if the county was issuing the 4 MW or the 31 MW permit. Rick Simon refused to answer Dave Brown's question.

SPI, the project proponent, did not know (five years into the permitting process) which agency was issuing the PSD permit.

The public was told a permit (94-TV-18) would be sent to Region for a 45 day review.

On July 12, 2013, the District of Columbia Appeals Court ruled that EPA must consider CO2 emissions (*Center for Biological Diversity v Environmental Appeals Board*). Despite the ruling, and the Board's orders to conduct a CO2 emissions analysis, Region later re-issued the 31 MW PSD permit on April 25, 2014 with an incomplete review tacked on. Region admits they relied on SPI to write this CO2 emissions analysis for them. 90% of the proposed hazardous emissions analysis was ignored/deferred until *after the permit was issued*.

On September 27, 2013, Shasta County AQMD "renewed" the still combined PSD permit/Title V permit to operate (94-VP-18b). Shasta County AQMD renumbered the permit 94-VP-18d and pretended it was only a Title V permit to operate. No explanation of 94-TV-18 was given.

The public and interested parties were never notified of this final federal action. Petitioner Celeste Draisner appealed the lack of notice by Region and Shasta County AQMD to the Board when it was revealed by Region on February 13, 2014.

On November 8, 2012, Region issued a Public Notice announcing they would hold a public hearing on December 10, 2013 for the proposed 31 MW power plant (SAC 12-01). I attended this public hearing with my wife, Joy. I entered oral comments into the record.

Currently, the PSD permit "modification" of 94-PO-18 is also under appeal.

ARGUMENT

I, Petitioner Russ Wade, would like to show the Board the April 29, 2014 Redding Record Searchlight article which describes the SPI cogeneration plant as producing over 400,000 tons of carbon dioxide per year, over 460 tons of carbon monoxide per year and 270 tons of sulfur dioxide per year, respectfully submit as Exhibit A.

This sounds like a coal plant generating electricity.

Unlike coal power plants, biomass power plants appear to be exempt from Best Available Control Technology ("BACT") analysis. Region had an obligation to review current technologies that could lessen the negative impacts from facilities that emit CO₂s.

I would like the Board to look at the April 2014 National Geographic article "Can Coal Ever Be Clean? Carbon Capture and Storage (CCS), Disposing of waste CO₂s," respectfully submitted as Exhibit B.

There is technology available to sequester these harmful gases. The technology would use 1/4 of the plant's energy to sequester the gases in the ground where they would have to be monitored.

In the National Geographic article, I learned that coal power plants are currently being built using BACT for carbon capture and storage.

These new technologies for disposing of waste CO₂s should have been considered in Region's CO₂ emissions analysis. The National Geographic article states, "One idea is to burn coal in pure oxygen instead of air. That produces a simpler flue gas from which it is easier to pull the CO₂. At the DOE's National Energy Technology Laboratory in Morgantown, West Virginia, researcher Geo Richards is working on an advanced version of this scheme." If the Federal Department of Energy sees this as a valid BACT technology, surely Region needed to consider it in their court ordered analysis.

The 31 MW power plant is being piggy-backed on a 4 MW sawmill that is already out of compliance.

Remember, the original environmental review was done by the wrong agency (Shasta County AQMD) to build a new 31 MW power plant that was not going to have a PSD permit. Shasta County AQMD, a state agency without PSD authority, conducted the hearings, notices and environmental reviews for the new 31 MW cogeneration project. Region stepped in at the last minute, using Shasta County AQMD's flawed analysis, and issued a new PSD permit

On August 6, 2010 Shasta County released a Public Notice for the SPI cogeneration power project.

Project description: The proposed project consists of the construction and operation of a new cogeneration power facility.

WHY THIS NOTICE? Shasta County, as lead agency, has completed a Draft Environmental Impact Report for this project.

On July 19, 2011, John Waldrop (representing Shasta County AQMD) wrote to SPI representative Shane Young regarding SPI's request to modify their existing 4 MW sawmill to allow construction of a 31 MW biomass power plant on the same property.

"The Shasta County Air Quality Management District received your renewal application for a Title V operating permit on June 23, 2011 and was deemed administratively complete on July 19, 2011.

Therefore the Title V operating Permit Application Shield is in effect. The application shield allows your facility to continue to operate under the current Title V Permit until the permit is renewed. Please note that all conditions contained in the current Title V Permit are still in force and you are not relieved of any requirements.

The County will begin processing the renewal application and may make modifications to the permit pending the processing of the Application for Authority to Construct of the 31 megawatt cogeneration plant."

Nowhere in the Clean Air Act is Region or Shasta County AQMD given authority to issue "application shields" that give a toxic polluter's application the same legal authority as a final permit. An application is not the same as a final permit. The Board must review this policy that Region is employing. When regulations and statutes conflict with the Clean Air Act, the Clean Air Act has final authority.

Shasta County AQMD was trying to permit the new SPI 31 MW biomass power plant without the required PSD permit from early 2009 until April 11th, 2013.

On September 12, 2012, Region released a public notice on their proposal to modify an unnamed PSD permit to allow SPI to build and operate a 31 MW cogeneration power plant in Anderson, CA.

On February 21, 2013, Region issued not a "modification," but a new PSD permit (SAC 12-01). Region ignored 90% of the proposed power plant's hazardous emissions (CO2s).

I have concerns about the integration of the PSD permitting analysis with reviews required under other laws. Region has been absent through most of the permitting of this "modification."

In February of 2010, ENVIRON International Corp. did an environmental assessment of the proposed biomass plant for Shasta County AQMD (page 1, Introduction.)

"Although the existing lumber manufacturing facility [4 MW sawmill] is a major stationary source of emissions, the proposed cogeneration unit [31 MW power plant] is considered a minor modification, and is therefore not subject to the requirements of the Prevention of Significant Deterioration (PSD)."

It states in Shasta County AQMD's May 2012 report (prepared by DeNovo Planning Group, Sacramento, CA) Final Environmental Impact Report- SPI Cogeneration Power Project for Shasta County, CA:

"EXECUTIVE SUMMARY

The new information regarding this project did not result in new significant and unavoidable impacts, nor did it result in an increase in the severity of a previously identified impact. The original Draft EIR concluded that the proposed project would result in a significant and unavoidable impact to greenhouse gases and global climate change. The County subsequently oversaw the preparation of a revised GHG and climate change analysis . . . provided by the project applicant. The revised GHG and climate change analysis resulted in a conclusion that impacts to greenhouse gases and global climate change associated with the proposed project would be less-than-significant."

The April 29, 2014 Record Searchlight article (Exhibit A) states, "Mark Pawlicki, a spokesman for SPI, said the permit, issued Friday, was good news for the community. 'It should have been up and running by now. There were delays and appeals, but we persisted,' Pawlicki said. 'It is a very big deal. We think it's good for us, good for the community and good for renewable power.'"

The Sierra Pacific Industries spokesperson said it is good for the community. That is true unless you breathe.

When Region received the request from Shasta County AQMD to review this project (following the April 11, 2013 public hearing), Region should have denied it on several grounds:

A) The Region had rescinded and revoked Shasta County AQMD's authority to modify PSD permits in 2003. Shasta County AQMD had no authority to be lead agency.

B) Shasta County AQMD was attempting to permit the construction of a new major stationary source of emissions (675% larger than the original plant) without a PSD permit. Shasta County AQMD's intention was to modify the existing sawmill's Title V permit to operate to include the new power plant.

C) Shasta County AQMD was attempting to modify a flawed PSD/Title V permit.

D) Shasta County AQMD tried to license the proposed 31 MW power plant as a minor modification of an existing 4 MW sawmill. Nowhere in the Clean Air Act is this allowed.

E) Shasta County AQMD conducted a federal action (renewing the flawed PSD/Title V permit 94-VP-18b/d) without notifying the interested parties.

F) Shasta County AQMD held a permitting process, including 2 public notices and a sign in sheet at the April 11, 2013 public hearing for a proposed permit (94-TV-18). This is significant because it appears to be removing the PSD portion of the permit without due process. The permit that was issued by Shasta County AQMD on September 27, 2013 was 94-VP-18d and *not* 94-TV-18. The public did not receive notice of this renewal of a federal PSD permit (94-VP-18d).

Instead of Region stopping the project when it received the paperwork for a 45 day review, Region issued this:

"PUBLIC INFORMATION SHEET

~OVERVIEW~

SPI-ANDERSON PROPOSED CLEAN AIR ACT PSD PERMIT MODIFICATION
(page 1) September 2012

What laws and regulations apply to EPA's Proposed PSD permit?

We have prepared this proposed permit based on our PSD regulations issued under the clean air act at 40 CFR 52.21. We believe that the proposed modification will comply with PSD requirements for the pollutants regulated under the permit. We have made this determination based on the information supplied by the applicant, our review of the analysis contained in the permit application, and other relevant information contained in the administrative record for this proposed action."

As lead agency of the project, Region used information generated by the project proponent (SPI) and a separate non-permitting agency. On June 26, 2007, SPI settled with the CA Attorney General's office for \$13 Million for violations including: "failure to report emissions above allowable limits" and "falsification of emission reports as a result of operator tampering with monitoring equipment."

Region stepped in three years after the process began, used the above information and rushed through a "modification," of a PSD permit they never identified until the end of the process.

In a letter dated Jan 22, 2004 from Walter Mugdan, EPA Region 2 Director of Planning and protection to Ms. Kathleen Antoinc, Environmental Director for HOVENSA, L.L.C an oil company in the Virgin Islands, it reads:

Page 6

"Re: Prevention of Significant Deterioration of Air Quality (PSD) Gas Turbine No.10 Modification

Dear Ms. Antoine:

On April 7,2003, the U.S. Environmental Protection Agency(EPA),Region II, received an application for the modification of the existing GT No.10 PSD permit...

The EPA concludes that this final permit modification meets all applicable requirements of the PSD regulations codified at 40CFR §52.21, and the Clean Air Act (the Act). Accordingly, I hereby approve HOVENSA's modified PSD permit for the GT No. 10 Project.

This letter and its attachments represent EPA's final permit decision,and is effective immediately.

A project description is provided in Attachment I [attachment I reads 'HOVENSA, L.L.C. GT No.10'], and the permit conditions are delineated in Attachment II.[attachment II reads 'HOVENSA, L.L.C. GT No.10']"

It looks like EPA's standard procedure for modifications is to use the existing permit's number and note the date and changes approved for the modification.

Region notified the public they were modifying an unnamed permit, issued by Shasta County AQMD.

When Region issued the 31 MW PSD permit, Region gave it a new permit number (SAC 12-01). I believe Region changed the number in hopes of burying the fatal flaws in the permit they were modifying.

Region disregarded the Clean Air Act when it attempted to permit a new major stationary source of pollution as a "modification."

Region failed the public in their duty to consult with other agencies and conduct their own PSD permitting process.

For example, Region did not complete an ESA (Endangered Species Act) section 7(a)(2) consultation with the U.S. Fish and Wildlife Service on the SPI 31 MW power plant project. Since SPI will be using the Sacramento River to dump their toxic waste water, consultation with U.S. Fish and Wildlife could have helped prevent harm to endangered fish species, such as the salmon.

Region's issuance of PSD permit SAC 12-01 is a federal agency "action" that triggers section 7's consultation requirements. The implementing regulations for section 7 define "action" broadly to include "all activities or programs of any kind authorized, funded, or carried out, in whole or in part by Federal agencies in the United States or upon the high seas." This requirement that Region ignored, specifically includes "permits" as well as "actions directly or indirectly causing modifications to the land, water, or air." 50 C.F.R. § 402.02. Issuance of PSD permit 12-01 is a single federal action and Region is responsible for that federal action under the ESA.

In this case, Region's transfer of their duty to Shasta County AQMD was based on the incorrect and unlawful position that Region can transfer its duty. Region cannot claim that its duties will be met by another agency's consultation on Region's separate and distinct action.

Shasta County AQMD was originally attempting to modify PSD permit 94-VP-18b, not 94-PO-18. How can the permit numbers be so easily switched halfway through the process? Nowhere in the Clean Air Act is Region given authority to do this.

Region is attempting to piggy-back a new power plant onto a sawmill permit at the end of the PSD permitting process.

There is a grammar school within 3/4 of a mile of those stacks.

Region cannot avoid its mandatory duties under the law. Region is supposed to protect our community by providing a fair process. Region should be protecting the health of children.

Serious errors in the permit process include denied public participation to an Environmental Justice Community.

Failing to issue proper public notices caused citizens to lose their rights to seek redress of grievances, and caused an injury in fact. (14th amendment, U.S. Constitution) (140 CFR 124.19)

PSD Permit No.94-VP-18b/d was erroneously renewed on September 27, 2013, over 8 months after it expired, a violation of 42 U.S. Code § 7661.

Denying Board consideration of notice claims would deny citizens in an Environmental Justice Community the opportunity to appeal to the Board and would be contrary to the Clean Air Act's emphasis on the importance of public participation.

A person who does not receive a notice of a final decision has been denied the threshold imposed by section 124.19(a), entitling that person to standing before the Board (Remand).

I, Petitioner Russ Wade, contend that the Region committed numerous procedural and substantive errors in their supervision of the issuing, modifying and renewing processes of PSD permits Nos. 94-PO-18(1995), 94-PO-18(1998), 94-VP-18(b/d) and SAC 12-01.

PSD Permit No.94-VP-18b expired on January 19, 2013. Nowhere in the Clean Air Act is Shasta County AQMD or the Region, as the supervising agency, allowed to renew or order the renewal of expired permits.

An expired permit, is by definition, an out of compliance permit. PSD permit 94-VP-18b was the *original* permit Region and Shasta County AQMD "modified" in the permitting of PSD permit 12-01.

CONCLUSION

Region authorized Shasta County AQMD to conduct three Environmental Reviews for this 31 MW power plant modification.

Now, Region is claiming they issued Sac 12-01 as a separate, new permit. Where is Region's environmental review for this separate, new permit?

How could I, or the public, honestly participate in this permitting process? First, the project was a modification of one permit and later it was issued as a new, separate permit?

Please review this matter and ask Region to obey their own regulations.

Respectfully submitted on May 23, 2014.



Russ Wade, citizen petitioner

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Redding, CA 96001
(530) 244-5250

APRIL 2014

GEOGRAPHIC



Wild Pets

THE DEBATE OVER
OWNING EXOTIC ANIMALS

CAN COAL EVER BE CLEAN? 28

A TALE OF TWO ATOLLS 62

THE VIEW FROM A GIANT TELESCOPE 76

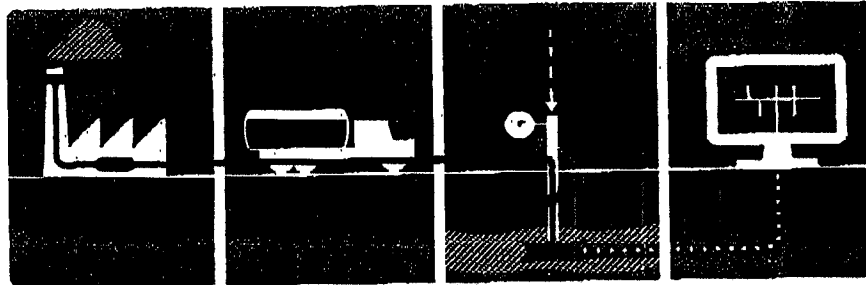
TOWERS OF LACE FOR BRETON WOMEN 86

DIGGING UP A ROMAN BOAT 120

Carbon Capture and Storage (CCS)

DISPOSING OF WASTE CO₂

Venting CO₂ from a smokestack is usually free, like littering. Capturing and storing CO₂ underground would cost up to a quarter of a power plant's energy—and a lot of money. It won't become the norm unless governments make it happen.



The four steps of capturing and storing carbon dioxide

Capture
CO₂ is separated from other stack gases and compressed into a liquid-like state. This is the most costly step in CCS.

Transport
Fluid CO₂ is moved to a storage reservoir. Pipelines are the most efficient carrier, but trucks, trains, and ships can do the job.

Injection
CO₂ is injected deep underground into a porous formation—an old oil field, say, or a saline aquifer—under a cap rock that deters leaks.

Monitoring
The reservoir must be watched in perpetuity for leaks. Even slow ones could defeat the purpose of preventing climate change.

Underground formations could hold 1,000 years' worth of emissions.

or at any of the handful of other large storage sites around the world. Scientists consider the risk of a catastrophic leak to be extremely low.

They worry more about smaller, chronic leaks that would defeat the purpose of the enterprise. Geophysicists Mark Zoback and Steven Gorelick of Stanford University argue that at sites where the rock is brittle and faulted—most sites, in their view—the injection of carbon dioxide might trigger small earthquakes that, even if otherwise harmless, might crack the overlying shale and allow CO₂ to leak. Zoback and Gorelick consider carbon storage “an extremely expensive and risky strategy.” But even they agree that carbon can be stored effectively at some sites—such as the Sleipner gas field in the North Sea, where for the past 17 years the Norwegian oil company Statoil has been injecting about a million tons of CO₂ a year into a brine-saturated sandstone layer half a mile below the seabed. That formation has so much room that all that

CO₂ hasn't in there's been n

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The CO₂ thi doesn't come f the natural gas seabed. Before i Statoil has to st

ART: ALVARO VUJINO
SOURCES: HOWARD HERZOG, MIT;
U.S. ENERGY INFORMATION ADMINISTRATION

CO₂ emitted by fossil fuels, 2011

21%

of global fossil fuel CO₂ comes from burning natural gas, mostly for heat and electricity.

35%

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natural gas, mostly
electricity.

3.5 million metric tons
Annual CO₂ capture
planned at first U.S. power
plant equipped for CCS

1.5 billion metric tons >
Annual CO₂ output
of all U.S. coal-fired
power plants

A small
beginning
for CCS

One U.S. power
plant, in Missis-
sippi, is now being
equipped for CCS.
It would take a
whole new indus-
try to make a dent
in U.S. emissions.

CO₂ hasn't increased its internal pressure, and there's been no sign of quakes or leaks.

European researchers estimate that a century's worth of European power plant emissions could be stored under the North Sea. According to the DOE, similar "deep saline aquifers" under the U.S. could hold more than a thousand years' worth of emissions from American power plants. Other types of rock also have potential as carbon lockers. In experiments now under way in Iceland and in the Columbia River Basin of Washington State, for example, small amounts of carbon dioxide are being injected into volcanic basalt. There the gas is expected to react with calcium and magnesium to form a carbonate rock—thus eliminating the risk of gas escaping.

The CO₂ that Statoil is injecting at Sleipner doesn't come from burning; it's an impurity in the natural gas the company pumps from the seabed. Before it can deliver gas to its customers, Statoil has to separate out the CO₂, and it used

to just vent the stuff into the atmosphere. But in 1991 Norway instituted a carbon tax, which now stands at around \$65 a metric ton. It costs Statoil only \$17 a ton to reinject the CO₂ below the seafloor. So at Sleipner, carbon storage is much cheaper than carbon dumping, which is why Statoil has invested in the technology. Its natural gas operation remains very profitable.

AT A COAL-FIRED POWER PLANT the situation is different. The CO₂ is part of a complex swirl of stack gases, and the power company has no financial incentive to capture it. As the engineers at Mountaineer learned, capture is the most expensive part of any capture-and-storage project. At Mountaineer the CO₂ absorption system was the size of a ten-story apartment building and occupied 14 acres—and that was just to capture a tiny fraction of the plant's carbon emissions. The absorbent had to be heated to release the CO₂, which then had to be highly compressed for storage. These energy-intensive steps create what engineers call a "parasitic load," one that could eat up as much as 30 percent of the total energy output of a coal plant that was capturing all its carbon.

One way to reduce that costly loss is to gasify the coal before burning it. Gasification can make power generation more efficient and allows the carbon dioxide to be separated more easily and cheaply. A new power plant being built in Kemper County, Mississippi, which was designed with carbon capture in mind, will gasify its coal.

Existing plants, which are generally designed to burn pulverized coal, require a different approach. One idea is to burn the coal in pure oxygen instead of air. That produces a simpler flue gas from which it's easier to pull the CO₂. At the DOE's National Energy Technology Laboratory in Morgantown, West Virginia, researcher Geo Richards is working on an advanced version of this scheme.

35%

comes from oil, which is used primarily to make various transportation fuels.

44%

comes from burning coal—the cheapest and dirtiest fossil fuel, used primarily for electricity.

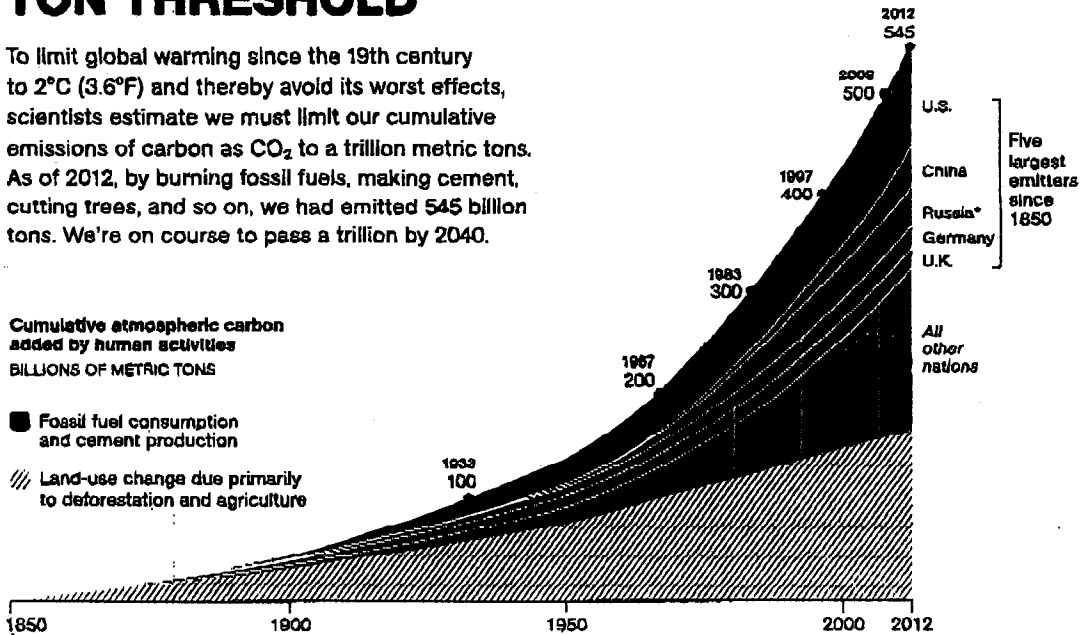
CO₂ and Climate Change

THE TRILLION-TON THRESHOLD

To limit global warming since the 19th century to 2°C (3.6°F) and thereby avoid its worst effects, scientists estimate we must limit our cumulative emissions of carbon as CO₂ to a trillion metric tons. As of 2012, by burning fossil fuels, making cement, cutting trees, and so on, we had emitted 545 billion tons. We're on course to pass a trillion by 2040.

Cumulative atmospheric carbon added by human activities
BILLIONS OF METRIC TONS

- Fossil fuel consumption and cement production
- ▨ Land-use change due primarily to deforestation and agriculture



"Come and see our new toy," he says, hunching his shoulders against a bitter Appalachian winter day and walking briskly toward a large white warehouse. Inside, workers are assembling a five-story scaffold for an experiment in "chemical looping." Making pure oxygen from air, Richards explains, is costly in itself—so his process uses a metal such as iron to grab oxygen out of the air and deliver it to the coal fire. In principle, chemical looping could radically cut the cost of capturing carbon.

Richards has dedicated more than 25 years of his career to making carbon capture more efficient, and for him the work is largely its own reward. "I'm one of those geeky people who just like seeing basic physics turned into technology," he says. But after decades of watching politicians and the public tussle over whether climate change is even a problem, he does sometimes wonder if the solution he's been working on will ever be put to practical use. His experimental

carbon-capture system is a tiny fraction of the size that would be required at a real power plant. "In this business," Richards says, "you have to be an optimist."

IN WEST VIRGINIA THESE DAYS, century-old coal mines are closing as American power plants convert to natural gas. With gas prices in the U.S. near record lows, coal can look like yesterday's fuel, and investing in advanced coal technology can look misguided at best. The view from Yulin, China, is different.

Yulin sits on the eastern edge of Inner Mongolia's Ordos Basin, 500 dusty miles inland from Beijing. Rust-orange sand dunes surround forests of new, unoccupied apartment buildings, spill over highway retaining walls, and send clouds of grit through the streets. Yulin and its three million residents are short on rain and shade, hot in summer and very cold in winter. But the region is blessed with mineral resources,

*U.S.S.R. DATA PRIOR TO 1992
SOURCES: THOMAS BODEN, CARBON DIOXIDE INFORMATION ANALYSIS CENTER/OAK RIDGE NATIONAL LABORATORY; U.S. DEPARTMENT OF ENERGY; N. A. HOUGHTON, WOODS HOLE RESEARCH CENTER; EPA

The rising CO₂ threat

84%

Portion of U.S. greenhouse gases emitted by human activity that is CO₂

800

including of coal. Gao Zh... fuel of y... The s... tuated v... plants, i... with do... for miles... grids of... banners... women i... cent of C... making... domestic... of indust... played by... Here coal... from plas... Coal ha... in total c... U.S. rema... China is... than ever... ten years... mental p... California... experienc... from not... agenda." T... quality, off... change, an... nological... dreds of bi... It's now a... solar panel... among the... country is a... and simple... These eff... and immig... Shenhua G

including some of the country's richest deposits of coal. "God is fair," says Yulin deputy mayor Gao Zhongyin. From here coal looks like the fuel of progress.

The sandy plateaus around Yulin are punctuated with the tall smokestacks of coal power plants, and enormous coal-processing plants, with dormitories for live-in workforces, sprawl for miles across the desert. New coal plants, their grids of dirt roads decorated with optimistic red-bannered gateways, bustle with young men and women in coveralls. Coal provides about 80 percent of China's electric power, but it isn't just for making electricity. Since coal is such a plentiful domestic fuel, it's also used for making dozens of industrial chemicals and liquid fuels, a role played by petroleum in most other countries. Here coal is a key ingredient in products ranging from plastic to rayon.

Coal has also made China first among nations in total carbon dioxide emissions, though the U.S. remains far ahead in emissions per capita. China is not retreating from coal, but it's more than ever aware of the high costs. "In the past ten years," says Deborah Seligsohn, an environmental policy researcher at the University of California, San Diego, with nearly two decades' experience in China, "the environment has gone from not on the agenda to near the top of the agenda." Thanks to public complaints about air quality, official awareness of the risks of climate change, and a desire for energy security and technological advantage, China has invested hundreds of billions of dollars in renewable energy. It's now a top manufacturer of wind turbines and solar panels; enormous solar farms are scattered among the smokestacks around Yulin. But the country is also pushing ultraefficient coal power and simpler, cheaper carbon capture.

These efforts are attracting both investment and immigrants from abroad. At state-owned Shenhua Group, the largest coal company in

the world, its National Institute of Clean-and-Low-Carbon Energy was until recently headed by J. Michael Davis, an American who served as assistant U.S. secretary for conservation and renewable energy under the first President Bush and is a past president of the U.S. Solar Energy Industries Association. Davis says he was drawn to China by the government's "durable

Yesterday's fuel? In China coal looks like the fuel of progress.

commitment" to improving air quality and reducing carbon dioxide emissions: "If you want to make the greatest impact on emissions, you go where the greatest source of those emissions happens to be."

Will Latta, founder of the environmental engineering company LP Armina, is an American expat in Beijing who works closely with Chinese power utilities. "China is openly saying, Hey, coal is cheap, we have lots of it, and alternatives will take decades to scale up," he says. "At the same time they realize it's not environmentally sustainable. So they're making large investments to clean it up." In Tianjin, about 85 miles from Beijing, China's first power plant designed from scratch to capture carbon is scheduled to open in 2016. Called GreenGen, it's eventually supposed to capture 80 percent of its emissions.

LAST FALL, AS WORLD COAL CONSUMPTION and world carbon emissions were headed for new

800,000 yrs

Minimum time since the CO₂ level was as high as it is today

108%

Increase in global per capita emissions between 1950 and 2010

records, the Intergovernmental Panel on Climate Change (IPCC) issued its latest report. For the first time it estimated an emissions budget for the planet—the total amount of carbon we can release if we don't want the temperature rise to exceed 2 degrees Celsius (3.6 degrees Fahrenheit), a level many scientists consider a threshold of serious harm. The count started in the 19th

The first U.S. power plant that will capture most of its CO₂ is under construction.

century, when the industrial revolution spread. The IPCC concluded that we've already emitted more than half our carbon budget. On our current path, we'll emit the rest in less than 30 years.

Changing that course with carbon capture would take a massive effort. To capture and store just a tenth of the world's current emissions would require pumping about the same volume of CO₂ underground as the volume of oil we're now extracting. It would take a lot of pipelines and injection wells. But achieving the same result by replacing coal with zero-emission solar panels would require covering an area almost as big as New Jersey (nearly 8,000 square miles). The solutions are huge because the problem is—and we need them all.

"If we were talking about a problem that could be solved by a 5 or 10 percent reduction in greenhouse gas emissions, we wouldn't be talking about carbon capture and storage," says Edward Rubin of Carnegie Mellon University. "But what we're talking about is reducing global emissions by roughly 80 percent in the next 30 or 40 years." Carbon capture has the potential to deliver big emissions cuts quickly: Capturing the CO₂ from a single thousand-megawatt coal

plant, for example, would be equivalent to 2.8 million people trading in pickups for Priuses.

The first American power plant designed to capture carbon is scheduled to open at the end of this year. The Kemper County coal-gasification plant in eastern Mississippi will capture more than half its CO₂ emissions and pipe them to nearby oil fields. The project, which is supported in part by a DOE grant, has been plagued with cost overruns and opposition from both environmentalists and government-spending hawks. But Mississippi Power, a division of Southern Company, has pledged to persist. Company leaders say the plant's use of lignite, a low-grade coal that's plentiful in Mississippi, along with a ready market for its CO₂, will help offset the heavy cost of pioneering new technology.

The technology won't spread, however, until governments require it, either by imposing a price on carbon or by regulating emissions directly. "Regulation is what carbon capture needs to get going," says James Dooley, a researcher at DOE's Pacific Northwest National Laboratory. If the EPA delivers this year on President Obama's promise to regulate carbon emissions from both existing and new power plants—and if those rules survive court challenges—then carbon capture will get that long-awaited boost.

China, meanwhile, has begun regional experiments with a more market-friendly approach—one that was pioneered in the U.S. In the 1990s the EPA used the Clean Air Act to impose a cap on total emissions of sulfur dioxide from power plants, allocating tradable pollution permits to individual polluters. At the time, the power industry predicted disastrous economic consequences. Instead the scheme produced innovative, progressively cheaper technologies and significantly cleaner air. Rubin says that carbon-capture systems are at much the same stage that sulfur dioxide systems were in the 1980s. Once emissions limits create a market for them, their cost too could fall dramatically.

If that happens, coal still wouldn't be clean—but it would be much cleaner than it is today. And the planet would be cooler than it will be if we keep burning coal the dirty old way. □

Part two

The world g
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is just a ghc

Photographs b



JHARKHAND, INDIA
A young boy carries
a chunk of coal into the
mining camp where he
lives. His family will burn
the coal to make coke—a
cleaner and hotter-burning
fuel—which they'll either
sell or use themselves for
heating and cooking.