ANUMUKTI

A Journal Devoted to Non-Nuclear India

Vol.5 No.6 June/July 1992

Now is The Time to Resist Uranium Mining in Meghalaya

The Centre has allocated "sufficient funds" in the Eighth Plan for the setting up of a commercially viable uranium processingunit at Domiosiat, 140 km from Shillong. It has also asked the Meghalaya government to acquire the necessary land for further exploration and resolve the ongoing dispute with the district council authorities at the earliest.

Uranium was found at Domiosiat in 1989 after five years of exploration work. Samples were rushed to the Atomic Minerals Division for testing. In 1990, the division's report confirmed the presence of a rich vein of uranium. In August 1991, an official announcement of the 9,959 tonne deposit of U_3O_8 was made. This is the largest single uranium deposit in the country after Jaduguda in Bihar.

Immediately after the uranium reserve was found in Meghalaya's East Khasi Hills, the local tribal residents raised a strong protest against further exploration as they feared large-scale evacuation from the area and adjacent villages. The irate residents also chased scientists and other staff with bows and arrows.

The tribal district council also raised objection over the acquisition of land for exploration work. The central government, in a letter issued last month, asked the state government to sort out the problem with the district council authorities and acquire the land for setting up of a semi-processing unit. The Uranium Corporation of India Ltd (UCIL) has also been asked by the Centre to step in and commence commercial mining.

Meanwhile, former state minister, Hoppingstone Lyngdoh led Hill People's Union joined the agitating local residents and is now trying to mobilise mass opinion against further exploration and setting up of any mining and milling unit.

Another major irritant is the Khasi Student's Union, which has recently stated that the Centre can begin exploration work only if it agrees to give 50 percent value of the mined uranium as royalty. The government has yet to react to this proposal.

However, two prominent Khasi leaders of the state — Prof.G.G.Swell and former Chief Minister B.B.Lyngdoh — have responded positively to the Centre's plan to begin exploitation as "Uranium is national property."

The two leaders have asked the Centre to ensure proper rehabilitation of the evacuated tribals. The ruling state Congress Government has also made it clear that it would take all measures to rehabilitate local residents, if required.

The local protest over the uranium deposit is remeniscent of that over the linking of the state by rail. The government's efforts to put Meghalaya on the country's rail map failed as local tribals resisted the move fearing "massive Invasion of plainlanders." They pointed out that natural resources and coal would be taken away from the state thereby "exploiting" the local residents.

However, sources in Meghalaya rule out any such protest this time against setting up of the proposed uranium unit.

Sujit Kumar Chakraborty
The Observer of Business and Politics
July 9,1992

A Reply

While the Khasi Jaintia Environment Protection Council (KJEPC) delegation, were discussing with officials in the Prime Minister's office, the KJEPC's stand on uranium mining and its demand to declare the Khasi and Jaintia Hills as a Nuclear Free Zone, we were shocked to read Sujit Kumar Chakraborty's article entitled: "Funds Allocated for Setting up of Uranium Unit in Shillong."

The article was revealing, both in its detail and scope of uranium mining and processing to be undertaken by the Government of India and also regarding the double standards of our political leaders, for in Shillong, the Meghalaya Federation of Regional Political Parties has passed a resolution against uranium mining and processing. According to press reports in Shillong, Mr D D Lapang, the Congress Chief Minister of Meghalaya has taken up the matter with the Prime Minister.

The Janata Dal in Meghalaya has also issued a statement opposing uranium mining in Khasi and Jaintia Hills. The Hynniewtrep National Council, a newly formed political party, has also resolved to support the demand for declaring Khasi and Jaintia Hills as a nuclear free zone.

The last para of Mr Chakraborty's article contradicts his earlier ones. In fact, the West Khasi Hills Action Committee and the Sohryngkham Area Development Council had sent telegrams and copies of their resolutions on the subject to the President and the Prime Minister but no response has come till date.

Rev.Prechard B.M. Basaiawmoit
Convenor, Khasi-Jaintia Environment Protection Council

From The Editor's

Recently, Jyotibhai Desai gave me **a** poem to read. I want to share it with you. It is written by a thirteen-year old child from SriLanka. And in these mad times, when the Chairman of the Atomic Energy Regulatory Board, — a person, whose first responsibility should be providing protection to the public, disregards mandatory safety **regulations**—(See following story) it is a solace to think that sanity still **prevails.**

BOX OF COLOURS

I had a box of colours
Shining Bright and bold,
I had a box of colours
Some warm and some very cold.

I see no red for the blood of wounds
I had no black for the orphan's grief
I had no white for the dead faces and hands
I had no yellow for the burning sands.

But I had orange for the joy of life
I had blue for the bright clear skies
And I had green for buds and nests
I had pink for dreams and rests.

I sat down and painted

PEACE

Critical Safety Checks Not Being Observed In KAPP-1

BOMBAY, JULY 25: Sources within the nuclear power industry are concerned about "a serious lapse" in ckecking vital safety installation at Unit-1 of the Kakrapar nuclear power project, which is due to be commissioned shortly. The "unwarranted haste" to achieve criticality, overdue by a year, has caused the project authorities to allegedly bypass 'integrated testing' of the "Emergency Core Cooling System" (ECCS). This is the only backup system available in case of a 'loss of coolant accident', and its failure could lead to a 'core melt down accident', they warn.

According to these sources who wish to remain anonymous, integrated testing of the ECCS is practically possible only once in the lifetime of a reactor. This back-up system automatically comes into play during a 'loss of coolant accident' (LOCA), when the normal reactor coolant drains out, and is not available for cooling the reactor core. This situation may arise if there is a breakage in any of the complex web of pipes that cool the system.

Under this integrated test, a LOCA is simulated, and all components of the ECCS are evaluated, with the primary heat transport system pressurised and heated up. In this simulated test the reactor core is not loaded with heavy water, and is instead flooded with ordinary (light) water. Once the reactor is set for critically, and the Primary Heat Transport System (PHT) is filled with the expensive heavy water, the integrated testing of ECCS is not possible.

Although injection of light water into the PHT is a component of the ECCS, its activation in a non-emergency situation would seriously harm the PHT system bacause the highly radioactive heavy water would contaminate ordinary water, becoming "downgraded" in the process. With heavy water costing Rs 10,000 per liter, and the PHT holding at least 40 tonnes, this would cause a major economic loss.

According to these sources 'integrated testing' of the ECCS is a mandatory regulatory requirement, and no other subsequent commissioning activities such as fuel-loading, addition of heavy water in the PHT system, can be permitted till this requirement is met. Apprehension *on* this aspect are clearly expressed in a note written by K. Natarajan, chief engineer (instrumentation and control) and a member of Kakrapar Design Safety Committee (KDSC). (See Box)

The Atomic Energy Regulatory Board (AERB) authorities, who were shown a copy of Natrajan's note, said they had no reason to doubt its authenticity, but dismissed its contents as opinion".

According to sources, this note make amply clear that 'integrated testing' of ECCS was not performed at all, or if performed, did

ECCS Tests in KAPP-1

Refer Report No KAPP/ 33350/ 92/B dated April 09,1992.

The tests have been repeated and new operating points set. They are acceptable for KAPP-1 operation.

However, a total integrated test with all the subsystems, components and logic functioning, should be done to confirm performance as per design intent in toto.

This must be done in KAPP-2 as soon as the system is ready and any retrofitting found necessary based on this test should be taken up for KAPP-1.

K.Natarajan
28.4.92

I agree. This would be done in KAPP-2

G.Ghosh
29.4.92

not meet with design requirements. They also state: 'The note also reveals apprehension regarding proper functioning of ECCS, else, the note would not have mentioned integrated testing of KAPP Unit-2 and possible retrofitting in KAPP Unit-1."

The sources further reveal that the NPC has permitted loading of fuel in KAPP Unit-1. This implies that the uranium rods and the heavy water are already loaded into the system, making it impossible for AERB to now demand compliance of the ECCS integrated test. 'The KDSC and the chairman, AERB, have overlooked the serious lapses in commissioning ECCS by the KAPP site management, by permitting the NPC to load fuel in KAPP Unit-1. No regulatory body anywhere in the world has displayed such gross lack of concern for safety by condoning inadequate testing of ECCS, the failure of which may lead to the severest nuclear accident," it was held.

The chairman of AERB, S. Soman, explained his stand during two hours of discussion with this reporter on Thursday, (23.7.1992) followed by questions submitted in writing and their reply similarly forthcoming. During the discussion, Soman revealed that "the process of criticality (for KAPP-1) has already started, and the review committee is going through that." Kakrapar Unit-1 is a replica of other CANDU type reactors, hence "safety is ensured". "We are not here to answer why it (integrated testing) has not been done, it is not our business. But we have to be satisfied that all tests have been properly done. They have to submit results of all experiments and if they are satisfactory, then only will our permission be given," he added.

When shown Natarajan's letter, Soman said he would confirm the specific position with Kakrapar Unit-1, but nevertheless defended "individual testing of the ECCS components", holding that "integrated testing could not be simulated." It is accepted that you test part by part, and be satisfied that all systems are normal. Integrated testing is by checking the design and indirect measurement, you look at it part by part. During the process of reviewing these, opinions (as by Natarajan) are being expressed."

Subsequently, in a written response, the AERB avoided use of the words 'integrated testing', as pointedly referred to in the written questions, and instead referred to "complete" ECCS tests. "Complete ECCS testing was tried out Narora 2 before it went critical. Some deficiencies observed during the tests were rectified and necessary tests to ensure the performence of rectified system carried out. ECCS at KAPP-1 is identifical to the one at Narora-2," it stated. Asked about "integrated ECCS test" at KAPP- 1, AERB said, "Complete ECCS has been tested for its functional performance at KAPP-1 before addition of heavy water to the PHT system." Asked about AERB's stand on testing ECCS before the reactor went critical, and whether "in toto testing" is an essential requirement, it replied, "ECCS should be checked for its performance before a reactor goes critical. Any deficiencies observed during the tests have to be corrected and functional checks carried out to ensure that the system functions as per safety requirement."

Meanwhile an independent expert, Shri R. Ashok Kumar, an electrical engineer and authority on energy audit, holds the failure of the CANDU type reactor design as serious. He questions why the Moderator Inlet Manifolds at MAPPS (Kalpakkam) broke in a 1990 incident, and whether it was a "remote possibility" at Narora and Kakrapara, thereby questioning the sound working of the Cold Moderator System in the event of LOCA under ECCS failure. "Inability to conduct full scale tests needed for LOCA, ECCS and Cool Moderator Inlet Behaviour raises serious questions over solution to the safety problem itself," he said.

Rupa Chinai
The Sunday Observer 26.7.1992

So That Others Might Live in Peace

Navstar Satellite Disarmed

Just before dawn on Sunday, May 10, 1992 Keith poller and Peter Lumsdaine entered Building 86 at Rockwell International's world headquarters in Seal Beach, California, where they partially demolished a NAVSTAR-GPS global targeting satellite and parts of the dust-free "clean rooms" where these satellites are assembled.

NAVSTAR-GPS ("Global Positioning System") is a far-reaching military "force multiplier" program, half-way to full deployment. Already in partial use, NAVSTAR will increasingly provide extremely precise data on the exact position, altitude and velocity of any designated object to U.S.military, police, intelligence or high-level corporate user, with less exact positioning offered as a spin-off benefit to the commercial/civilian sector.

If NAVSTAR program is allowed to go forward it will increasingly: guide counterinsurgency assault teams and gunships on search-and-capture or search and-destroy missions against Third World resistance movements, "illegal" refugees, and indigeneous communities in previously remote rainforest/mountain sanctuaries or urban slum back alleys-

day or night anywhere on the planet; and

• provide the Pentagon's nuclear missiles with the unprecedented accuracy needed only to start and win World War III through a catastrophic first-strike on the nuclear deterrent forces of any future rival, especially a resurgent Russia or Eurasian alliance.

NAVSTAR also greatly facilitetes corporate-state surveying and mapping of every remote wilderness, desert, rainforest and indigenious nation on Earth for "resource" exploitation and control. In the war against Iraq, NAVSTAR guided much of the bombing campaign, including B-52 launched cruise missiles destruction of Iraq's civilian infrastructure.

Axing The Satellite

After slipping into Rockwell's fenced and patrolled Space Systems compound with tool boxes, the two unarmed saboteurs changed from black apparel to regular work clothes with Rockwell-logo shirts and fascsimiles of company security badges, which they were wearing when apprehended in Building 86.

The steel mesh reinforced windows to one NAVSTAR "clean room," containing seven uncompleted GPS satellites, were removed with an ordinary wood splittingax, introducing un filtered air as well as specks of glass and metal into the dust-free environment, potentially causing problems for the precision satellites being assembled there. The door of a second clean room was meanwhile broken open and one NAVSTAR inside was struck about 60 times with another ax. This completed satellite, awaiting shipment to the pre-launch facility at Cape Canaveral Air Force Station, has had to be completely disassembled by Rockwell technicians to assess and repair the damage. To date, damage is estimated to be at least $ 5.5 million. Rockwell and government sources reportedly say this figure is expected to rise as the investigation proceeds.

Armed security and other Rockwell employees were present in the building and within a few minutes Lumadaine was seized at gunpoint. Kjoiler was tackled and choked unconscious, later requiring stitches over his blackened left eye. Before being assaulted by security guards, both clearly stated they were unarmed, and they neither threatended nor struggled with anyone.

Kjoller and Lumsdaine, who issued a three page statement after the action, chose the name The Harriet Tubman-Sarah Conner Brigade" for their nonviolent direct disarmament effort. The name honours the 19th century "Underground Railroad Conductor" and the fictional nuclear resistance fighter of the popular movie *Terminator II:Judgement Day.*

A Call To Conscience

Their statement affirms:

"NAVSTAR" is the space-age mechanical bloodhound of the world masters, guiding their hired guns as they track down the rebellious and runaway slaves of the corporate state, from the mountains of South and Central America to the back alleys of South Central Los Angeles. And it is also the real-life Skynet/Deathstar of our culture's movie theater nightmares, propelling the Earth's peoples toward an automated global holocaust of nuclear fire and darkness.

Kjoller and Lumsdaine are from Santa Cruz, where Kjoller earned a degree in sociology from University of California and produced a radio program for the University radio station. Lumsdaine lives with his four year daughter Lucy and is a member of the local Pax Christi group. He has worked for two years as the coordinator of the Silicon Valley's Interfaith Peace Coalition. Both have been actively involved in previous civil resistance movements in the area.

In a letter to the judge, Lumsdaine explained the factors that influenced his decision to act:

"Lucy and I are very close emotionally and my devotion to her is very strong... I of course realised that the action I took might result in a substantial period of physical separation from Lucy, a fact that deeply concerned me. Nevertheless, I took this action just as other devoted parents in various lines of work—international relief workers, soldiers, journalists, diplomats and even clergy members—find it their duty in conscience to take certain risks in their line of work which may result in extended separation from their children and families or in capture, injury or death. I strongly believe that people, including parents of young children, have a responsibility to take serious risks at times: to defend children from the socio-economic, ecological and military violence that is inflicted on them in many areas of the worla; and to defend all children, including their own, from the threat of global nuclear holocaust, a threat which remains perilously real notwithstanding the currently fashionable but short-sighted conventional wisdom.

Under current sentencing guidelines, Kjoller and Lumsdaine are expected to receive a sentence of around three years, plus possible supervised parole, fines and restitution.

Kjoller and Lumsdaine request that people support them by:

- Resistance organising against NAVSTAR and the corporate war machine.

- Short letters of support/encouragement to Lucy, Peter Lumsdaine's four-year-old daughter, c/o Jean Peterson P.O.Box7061 Santa Cruz, CA 96061 U.S.A.

For more information, contact:
The Tubman-Conner Brigade
c/o Maxine Ventura
P.O.Box 11645
Berkeley CA 94701
U.S.A.

The Nuclear Resistor
June 19,1992

Et Tu Brute

Can Nuclear Pay Its Way In India?

Nuclear Engineering International is an industry journal, and that is precisely why the following article is important. This is the first time that I have come across a piece in an industry journal that so clearly talks about the hidden subsidies enjoyed by nuclear power. We are reproducing the article in full, without any editing.

India's economy is to a great expnt centrally planned, and electricity supply, like other essential industries is nationalized and subsidized. All sources of supply are supported — coal, for example, is transported by rail at less than cost price — but the government decides which sources should be favoured. While Rajiv Gandhi was enthusiastic about nuclear industry, the new administration under Narasimha Rao has other priorities, and under pressure for, inside and outside India it is reducing subsidies and introducing some market policies.

At first sight the India nuclear industry seems to be moving successfully towards a commercial footing. Responsibility for plant operation and construction was devolved from the Department of Atomic Energy (DAE) to a quasi-commercial company, Nuclear Power Corporation (NPC), in 1987. The new arrangement allowed NPC to obtain provate financing, make its own investment and operation decisions and retain any profit. According to NPC the company has had a good record, making profits of up to Rs.750 million in its first three years and selling power at prices similar to those of coal fired plants. Such figures would give NPC a rate of return of around 11% — a considerable achievement when the average rate of return of India's nationalized industries is barely above *1%*.

NPC is able to keep its prices low and record a profit because of continuing support from central government. It is subsidised in a number of ways:

Fuel Price:

NPC buys its nuclear fuel from the Nuclear Fuel Complex (NFC), another quasi-commercial company of the DAE. If all the production costs were taken into account, fuel bundels would cost around Rs 1,000 each. Instead, the fuel is "hired" from NFC at an administrative price set by the DAE. In 1989/90, NPC's total fuel bill, including the first load for Narora-1, was Rs 21.6 million. The price of fuel, however, is now being gradually increased to a more representative value.

Heavy Water Price:

The true cost of NPC's heavy water would be around Rs 4,000/kg. In practice, it is assumed to be a non-depreciating asset and is leased to NPC. The company's total heavy water bill in 1989-90 was Rs 18.7 million.

Research and Development:

NPC has no research and development capability of its own, although a small laboratory is planned. It relies on DAE facilities at the Bhabha Atomic Research Centre (BARC) and elsewhere. These DAE facilities provide a variety of services for NPC: they provide experts for planning or problem solving groups; they design and manufacture high technology or one-off equipment that cannot be supplied by Indian industry; and they are always available as a reservoir of expertise. The DAE budget for research and development totals Rs 2,100 million. The budget covers more than just nuclear research and development — BARC's work, for example, extends to food irradiation, new alloys and electrical goods — but only now is the DAE's resarch for NPC beginning to move to a contract and payment basis. Previously, the two organisations continued to work on the informal basis that was in operation when both were run directly by the DAE.

Waste Disposal

Althogh NPC, through each plant, deals with its own low and intermediate level waste, it has no responsibility for spent fuel. This is stored at the plant until it can be moved to BARC or another future site for reprocessing. None of the costs are borne by NPC: research and development for reprocessing technology is carried at BARC and it is assumed that the cost of transport and reprocessing of fuel, as well as any subsequent decommissioning costs, will be covered by the value of the plutonium recovered.

Risk Insurance

NPC bears none of the costs of insuring against the risk of a nuclear accident or of compensation in case of such accidents — this is assumed to be a government responsibility.

Rajasthan Atomic Power Station

The two unit plant at Rajasthan is regarded as a prototype and is still owned by the DAE. It is operated for the DAE by the NPC.

Indian Plant Derating

- Tarapur: 2x220 MW BWR

Startup: 1969
Derated to 160 MW due to corrosion in steam generators and damaged generator rotors.

- Rajasthan: 2 X 220 MW and 2 X 235 MW PHWR

Startup unit 1 1973, unit 2 1981, units 3 and 4 due 1995
Units 1 and 2 derated to 100 MW due to leaks in calandria and shield wall (now mechanically sealed) and cracks in turbine blades.
Units 3 and 4 are expected to be derated to 220 MW.

- Madras: 2X235MWPHWR

Startup unit 1 1984, unit 2 1986
Operating at 175 MW following failure of inlet manifold. Derating likely to be permanent.

- Narora: 2 X 235 MWPHWR

Startup unit 1 1990, unit 2 due late 1991.
Construction was delayed because of backfitting and testing new safety systems.

- Karkrapar: 2 X 235 MW PHWR

Startup unit 1 due early 1992, unit 2 due late 1992.
Expected to be derated to 220 MW.

- Kaiga: 2 X 235 MW PHWR

Startup due 1995
Expected to be derated to 220 MW

Investment

As a commercial company, NPC is expected to raise one third of its financing from internal resources, one third from private borrowing and one third from government funds. At its healthy rate of return, NPC has been able to attract private funds but its internal resources are low and government funding has been raised to 50%. Nor are these the only subsidies. In the past, the government has been willing to compenate NPC directly if production costs cannot be met by the electricity price.

Assets

Nevertheless, if the Indian nuclear industry has commercial power production as its aim, it does now have some of the right ingredients:

A Standardised Design

The six units currently in operation have very different designs and have been plagued by problems. In contrast, the next 12 units—Narora 1 and 2, Rajasthan 3 and 4, Kaiga 1 to 6 and Kakrapar 1 and 2 will have a standard design, referenced to Narora 1, which incorporates all post Three Mile Island (TMI) upgrades.

Faster Construction

NPC aims at construction times around six years for the current pressurised heavy water reactor series.

A Qualified Industry

When the Indian nuclear industry was isolated in the 1970s, Indian companies could not supply components or equipment qualified to nuclear standards. The DAE and more recently NPC, have worked to upgrade local industries and now, although components cannot be bought "off the shelf," two companies have "N" stamps, and NPC has the security of regular supplies.

Indigenous Suppliers:

Early plants were held up when components from overseas were unobtainable. For example, the startup of MAPS 2 was delayed for ten years by a shortage of heavy water. Nearly 90% of the components are now Indian made, and mechanisms are in place to allow the DAE to work with industry where specialist equipment is required. Using local supplies also helps in conserving foreign exchange.

Cheap Manpower

Manpower cost in India is half that of Western countries, although a much smaller proportion of the work is automated.

Indigenous suppliers and the low cost of staff have already contributed to the low costs of Indian plants, according to P.K.Iyengar, Chairman of the Indian Atomic Energy Commission. Capital costs of Indian plants were around Rs 25,000 per kilowatt ($l,000/kw) and running costs are also low.

It remains to be seen whether NPC can make the most of its assets. Indications are that although NPC, and not the DAE, is making operating decisions, commercial thinking is still a long way off. Western suppliers, for example, have found delivery dates for their components put back as construction schedules are stretched.

In the medium term NPC is going ahead with plans for a new 500 MW reactor, although estimates are that capital costs and electricity price will be more than double those of the 235 MW series.

Commercial electricity production is not the only goal of a nuclear power programme such as India's. The implementation of such a programme brings with it a measure of international prestige, and associated research and development can give great benefits in "spin-off' technologies. But the overriding concern as Iyengar pointed out in a recent lecture to the Indian Institution of Engineers, is that "a minimum level of electricity production is essential for our survival."

The danger for the nuclear industry is that it may overestimate its importance in meeting that objective. Even with India's uranium and thorium resrves and with the problems associated with fossil fuels, unless nuclear power can show some commercial advantages, in a harsh economic climate it may be all too easy to replace the nuclear 2.5% with simpler cheaper technology.

Janet Wood
Nuclear Engg International
December 1991

Die, Brother, Die

The Atomic AIDS of Semipalatinsk

"Come, dear guest from abroad, don't ask too many questions, but do take more pieces of the ram. We have slaughtered it for you." The faces at the dining table shine with vodka and fine speeches: the plates are filled with mutton and noodles; the Chairman of the district Soviet, the Mayor of Dolon and all the other dignitories of the village beam with delight.

"Come, dear guest, don't be too inquisitive, drink the glass empty, because you are in Kazakhstan: And the best thing to do is to pour another glass down yourself, because you are at the "polygon", the testing range."

Vodka has always been a good antidote for radiation, says the Chairman of the district Soviet, without smiling. In the early fifties, when the first bombs were dropped, the army occasionally gave orders to distribute hundred grams of vodka to the farmers around the Polygon.

During the explosion the school children had to line up in front of the school at the hour of the exciting spectacle and look up to the horizon. A red ring grew in the sky, became larger and larger, sank to the ground, became whiter and whiter, grew legs, penetrated into the soil and rose again as a majestically ugly mushroom cloud.

"Look at me, dear guest, I am 45, boasts the Chairman, but don't I look younger? The atom dose it, it keeps us young."

In the course of the years between 1949 and 1989 the red ring in the sky glowed and turned itself into the mushroom cloud 166 times; the bombs exploded 343 times underground and made the windows rattle.

"Take more mutton, dear guest, have no fear; our village supplies meat and vegetable to Semi palatinsk, and people are ofcourse still alive there!"*

500,000 Kazakhs live around the testing range. Fallout equivalent to 15,000 Hiroshima-bombs have rained upon them. The army generals were playing Russian roulette with the people: The direction of the wind determined if the radioactive cloud would sail over the villages in the south, north, east of west.

When he once travelled abroad with his family, says the Chairman at the table, the Russian customs officer asked him, after looking at his passport, doubtfully: "What, you are from Semipalatinsk? But your children look so healthy?'

Their native place Dolon is in the north of the Polygon; opposite, on the other side of the atomic landscape, is Kainar. Usually the wind blew in this direction.

Whenever Danletkali Kodjajew, a hunter from Kainar, saw the atomic mushroom proliferating in the sky, he drank snake's blood, mixed with horse milk, and looked forward to hunting. The wild goats, deers and wolves were disturbed during every explosion, making them an easy catch. But this 62 year old man has not got hold of a hamster since long, even swallows have vanished from his hunting grounds.

When the earth shook, he knew, that somewhere on his next expedition he would come across a new hill or a new valley.

Kodjajew wanders even now through the hills, for hunting, thought it is prohibited since three years to eat that meat. Since even the soldiers give him hunting orders, the game should not be so dangerous, he hopes. Once in a month he could eat meat, the officers tell him, it doesn't cause any harm.

He should not talk too much, calls out Kodjajew's wife from the bedroom into the passage. "She is still afraid", he confides in his husky voice. Till three years ago, it was actually prohibited to talk about the bomb." He beckons us over to the kitchen of his hut.

His son is standingon the kitchen bench and covers his ears. He stares at the bulb of the ceiling light. He ignores us. Kodjajew ignores him. His son is insane, the father tells us later. Every child in Kainar lacks something, either the fingers or the arms, either the speech or the sense.

Recently Kodjajew tracked down a four meter long snake under a rock. It was without the hindquarters.

Samakal, the son of the hunter, is 32 years old. He suffers from congenital moronism. If this son doesn't take the medicine that quietens him down regularly, says Kodjajew, he bahaves like a rabid wolf. Samakal cowers in the comer of the kitchen and pulls at his thin goatee beard. He repeats every sentence of his father like an echo, without locking up.

"Only drunkards get such sons", the doctors used to abuse Kodjajew. He never drank, no vodka, no beer, only occasionally kwas. "I am a simple man", says the hunter, "but I can build a car". His carriage is parked in the yard. Kodjajew has built wooden bodywork around the chassis of a motorcycle. His car has space for two persons, has a big luggage aarea and runs 60 km per hour.

Samakal follows us, apparently indifferent, to the yard. He kicks a cow that blocks his sight, at the hind leg, till he trots off.

The house wife has woken up and calls for a brandy. She is sitting on her bed, under the picture of a lion, and writhes with asthama attack. She is ashamed because she is not keeping well, says the 62years old. The illness has wrickled her face like that of an 80 year-old.

She nursed her son for such a long time, she laments, till she herself feel ill. Samakal repeats her words. He sits on his bed, under the poster of Arnold Schwarzenegger, and swings his body to and fro.

Both patients are now nursed by the daughter. Surrounded by illness all her life long, she decided on her early age itself to become a medical doctor. Now she is crushed by the ubiquitous infirmity in Kainar. In the neighbouring house 50 years-old Nurkan Suneejewa, who can walk only on crutches, is suffering. Her sister cannot even get up any more.

Fifteen beds are available in the small hospital of the doctor, but atleast 100 villagers need treatment every month. 201 out of 3500 villagers have already died of cancer.

The number of deformed children is growing, the most serious cases perish anyway shortly after birth. Their nember tripled in the last three years. Every fifth child is born dead.

Japanese doctors who visited Kaniar and measured the radiation, told their colleagues: "You can't live here any more."

In the neighbouring village Sarshal, about 100 kilometers away, a highly dangerous quantity of the nuclear fission product Strontium 90 was found. It destroys the bone marrow and thus prevents the formation of blood. The radioactivity in the blood, urine and excrement of the farmers is 120 times higher than expected due to natural radiation.

Leukaemia, anaemia, asthma: hundreds of villagers have fallen ill and perished. 11ldied of cancer, 97 died by hanging. Only the strongest farmers in Sarshal, about 23,000, have survived the radiation; and the wisest among them gather occasionally in the council of elders to record any new signs of threat.

The gases leak out of the 'borehole 918' near the village which the military maintained in the steppe, in order to measure the convulsion in the bowels of the earth. The earth is screaming", say the elders. A shepherd with a broad for cap says that a jeep with two soldiers approached the borehole with gauges. They fled form the spot, as if hounded by wolves". Another describes a huge toungue of fire sticking out of the 'borehole 1010'. It was extingushed thrice.

Muratchan Korganbajew, the Chairman of the village committee, has found fresh deep holes and suspects that new tests are being planned or nuclear waste is being dumped secretly.

Korganbajew, 54, suffers from a terrifying growth of extremities: the hands, the legs, the head and even the tongue swell up. As if someone is pumping them up.

Melgis Metow would be happy if someone would give attention to his suffering. He is just weak and ill. He stutters, he cries, he looks tired; but this is the condition of many 54 year-olds in Kazakhastan. Metow's left eye flutters in the rhythm of a wild melody when he talks about his life as a soldier. He was forced to keep quite for 30 years, was intimidated by occasional visit of the KGB and by his faith in Soviet power.

The distance between him and the nuclear mushroom was 15 kilometers when soldier Metow first experienced the nuclear explosion. It was so bright that he was afraid, he would go blind Inspite of his dark glasses; when the shock faded away, the view of the man-made natural spectacle excited him. He saw a whitish-yellow ball that turned first into orange and then bright red, and grew and grew, till it filled the whole sky. A huge, white smoke cloud rose from the earth. Its surface blazed in shining red; a thick stem grew in slow motion from the bottom till the cloud stood majestically over the steppe...Deathly silence.

Metow saw the explosion storm drawing near, saw an invisible wave press the grass in the steppe, felt for seconds the heat of campfire inspite of the cold of the autumn, just before he pressed his head on the earth.

The wave shook up Metow and chased him into the hut where he lay down at the door. Windows, though open, shattered.

Half an hour leter he and the other 59 soldiers of the special pioneer unit No. 52605 were given cotton overalls and gumboots. They got breathing apparatus and the order to move towards the centre of the explosion.

In the months prior to these moments of destruction, 20 000 soldiers constructed the four storyed buildings, laid the pipes, parked the cars, constructed the illusion of a town. Now the special unit inspects the ruins in order to measure the power of the destruction; they collect the dosimeters which they had installed earlier, and also the chicken, pigs and sheep which they had released.

Cars and tanks are burnt down, the houses have collapsed, water flows out of the broken pipes. The town is as if it were painted with a black paste. Even the underground metro is damaged, but it still runs.

Metow and his comrades work their way gradually up to the centre of the inferno. Their goal is to reach a bunker which they had, before the zero hour, crammed Ml with gauges. A pin, attached to their clothes, measure the absorption of radiation without they themselves being able to understand the recordings.

Only 30 years later is Metow being informed, after he repeatedlly requests for a certificate, that he had been exposed to radiaton of 3.05 roentgen for 41 days. Metow doesn't trust that paper. After all a nuclear bomb was exploded every second week in the two yoars of his military service during 1961 and 1962.

In the last minute panic, the scientists and the generals let the sky over Semipalatinak glow because, from August 1963, atmospheric nuclear tests were forbidden.

The Chinese and the French continued to bomb overground, the Americans and the Soviets blasted henceforth under the earth. Together, they have triggered off 1800 nuclear explosions till today and spread radioactivity equivalent to 40,000 Hiroshima bombs on the earth. These radiations will, according to an international study, lead to the death of 430,000 people of cancer by the year 2000.

One third of the 343 underground nuclear tests in Kazakhastan did not remain under the earth. Radioactive clouds emitted from the brusting rocks and spread over the villages.

The nearer they live to the source of fright, the sooner people commit suicide. In the non-radiated areas of Kazakhastan, 2 out of 10 000 people hang themselves. In the area 160 kilometers from the testing range, the suicide rate is 24; at 120 kilometers distance it is 47 people, and at a distance of 40 kilometers, 80 out of 10 000 Kazakhas commit suicide.

Many people like Arnold Steiger fear that they have cancer. The farmer from Sarshal hanged himself three years ago. His father, George Steiger of German origin, laments in the council of the elders that military have not even paid for the damages of the buildings which their bombs have caused.

Each time, the roof of his house was swept away by the shock waves. Steiger was staying only three kilometers away from the Polygon till last year. Only once the soldiers dumped ten asbestos sheets, some cement and a few planks in front of his hut.

Every furrowed face in the council of the elders expresses fury. But Korganbajew, the Chairman of the village committee with the terrifying growth of extremities, shouts it out, the contempt, so loud as if his vocal chord also grew in the course of the decades by radiation.

The villagers were always being examined thoroughly: the farmers from Sarshal in Semipalatinsk were being investigated for many days in the secret hospital No. 4; the medical personnel were sniffing around in the village for weeks; the gauges were constantly registering the radiation,—"but we, the people who live here, don't know the whole truth about ourselves."

The snow-covered landscape between Sarshal, south of the Polygon, and Dolon, in the north, appears from the helicopter like a natural park. Wild horses run through the steppe, sheep look for food, wolves draw their circles. But some or the other hill appears to be artificial, as if man and his bomb have modelled them. And ofcourse the seas - neatly circle precision work.

At 50 degree north latitude and 79 degree east longitude, where the frozen rivers Shagan and Ashtshyssu meet, one finds the most beautiful creation of these lakes. The crystalline white snow-cover glitters in the sun, the brown white jagged edge looks as if chiselled by the diamond cutter.

"1004" is the name of this pearl. It has a diameter of one half of a kilometer and is 100 meters deep. Created on 15th January 1965 at 5.59 hours through a nuclear explosion that had a strength equivalent to nine Hiroshima bombs. The sea is the monstrous product of that mind (which existed at that time not only in the USSR), which thought that man could construct canals, lakes and ports with nuclear power.

120 "peaceful" bombs were exploded in many parts of the country between 1963 and 1988 in order to divert the rivers, to tap oil fields or to creat underground caves, - the dictatorship of the proletariat carrying forward the class struggle against nature.

When the atmospheric nuclear explosions were banned in 1965, soviet scientists invented a good excuse: the experiment 1004 has "by mistake" drilled through the earth surface. Iodine 131, Caesium 137 and Strontium 90 were blown all over the steppe.

The radiating lake "1004" served later to water the surrounding meadows and for fish-farming. The anglers appreciate the catch which they fish from the water - inspite of presence of Strontium 90, one thousand times in excess, compared to non-contaminated water.

This fission product requires 29 years to reduce itself to a half. More than half a million people around the Polygon have absorbed this and other radioactive parti" cals through respiration, food and skin. They cause cancer in the body and destroy the genetic make-up; continuing the process through the next generation and the generation thereafter and so on...

In the hospital of Dolon, three generations of infirmity are being treated. The 71 years old Balanowa suffers from gullet cancer, the 42years old Aldishewa has bronchiatic asthama and Olga, 14 years old, is struggling with nephritis.

Olga has never seen an atomic mushroom in her life, but she knows well how it looks like. It is always around her since the time she could think. And it is growing, from the moment she suddenly got fever two years ago and had to urinate often.

The kidney pains come in longer streches and force her to leave the school and stay in the hospital. The pain is unbearable without medicine; at present the hospital has no medicine; Olga couches curled up in her bed.

Olga's parents were children when, about 100 kilometers away from Dolon, on 29th August 1949 at 7.00 hours the "RDS-1" exploded. RDS—an abbreviation for "Rossija delajet sama" means: Russia does it independently. The Americans call the first Russian nuclear bomb "Joe 1" affectionately, after Stalin.

Its explosive force: 20 kilotonnes, about one and a half of the Hiroshima bombs. Hight of explosion: 38 meters. Wind speed: 70 kilometers per hour.

The nuclear cloud, expanding in the low altitude, reached Dolon in about 90 minutes. The radioactive fallout rained for three hours on the village. Olga's parents belong to those 70 000 people who were exposed to the gamma rays.

Olga was never well in her life. She had pneumonia before she got nepritis, had skin rash before pneumonia, and before the skin rash... She has "allergy to her own body", the doctor says and he has many such young patients.

Every second child in the radioactive contaminated areas suffers from chronic diseases; the immunisation system of half of the population has "reached the lowest norm", says a government report;

40 percent of the boys are too ill or mentally disturbed to do military service; new born babies have very few helper cells in their body, like the AIDS infected babies.

The children of the nuclear-test-generation inherit the nuclear AIDS from their parents and grandparents; 60 percent of them have been identified as having defective chromosomes. A Kazhakhi doctor had diagnosed right in 1958 the defect in the immune system, caused by radiation. He called it "Kainar Syndrome." He was forced to stop his study.

In the strictly shielded hospital No 4 in Semipalatinsk, people were examined but not treated. More than hundred medical doctors examined about 50,000 victims of radiation since 1961, without treating them. When someone died, he never died of radiation, but always of influenza or of heart failure. The chief of this 'hospital' tells about the collaboration: The Soviet Government, the army chiefs and unfortunately also some scientists were not merely interested in the hydrogen bombs, but they wanted the nuclear tests to create the conditions closer to that of a nuclear war".

Olga, Altishewa and Balanowa will not survive this Soviet nuclear war against its own folk. The 71 years-old vomits all that she eats; she has metastasis in the lungs. The doctor in the hospital of Dolon has not even morphium to make her death easier, he needs an inhalator for the 42 year-old asthmatic, and for Olga painkillers and somewhere a dialysis facility.

The malicious effect of the nuclear tests is the delayed, quite death, laments the doctor. 'Semipalatinsk' does not have the support of a lobby in the world as 'Chernobyl' has. A few injections occasionally, sometimes a few tins of tomatos, that's all what has reached this secret disaster area from the international aid for the new States.

Since Kazakhastan has become an independent country, this hospital receives less medicine than ever before, criticises the doctor. He shows us the disheartening medicine cabinet, though the chairman of the district soviet nudges him to shut up.

"Come, dear guest from abroad," the chairman says, you are in Kazakhastan, don't question so much, let us have our meals. "

He has choosen the house of a family with three healthy children to offer the guest mutton with noodles.

We won't show him the midget and the bigwig twins anymore, whispers the Chairman to the village soviet. He thinks, our interpreter did not hear him.

"Come, dear guest, take a piece of the fish. The round tea is safe. And its fish too. I myself have taken bath in "1004". And my son too."

Sasha, the interpreter, sings a song, the song of a dying Cossack. Black crow, fly. bring this ring to my wife and tell her: I have merried another. I have married death.

"Dear guest, drink and don't enquire too much, eat the apples from the Polygon. Don't they appear around and nutritious?"

A patient in the hospital had asked us: "Had that all been a natural disaster?" He pulled his shirt up and showed us the tumours on his back as thick as a fist. "I will catch those guys," he hissed, "even if I have to dig them up from the grave."

Cordt Schnibben
Der Spiegel
4th May 1992

Translated By: Arun Kotemkar

ALTERNATIVES

Untying Aids Knots in Nepal

Nepal's new found freedom through its discovery of democracy has proved popular with the 'free world'. In fact, the donor community's latest obsession with its newest tool for aid conditionality, the requirement for recipient countries to demonstrate 'good governance', probably helped to precipitate resolution of the pro-democracy struggle of 1989/90, so as not to threaten Nepal's access to the aid coffers. Few countries are so tightly strapped by foreign aid than this small, mountainous Kingdom and the established overseas agencies don't escape with a clean slate.

Nepal's options for power generation clearly illustrate many of the problems encountered in the aid game. As the country has no fossil fuel resources of its own, renewable energies have been seen as its panacea. The massive, untapped potential of the 6,000 streams and rivers that rush down from the Himalayas point to hydro-electric power as the obvious choice.

The former Panchayat Government, to its credit, had not dismissed the idea of small-scale, decentralised energy production. In 1984, it delicensed micro-hydro power (ie schemes generating up to 100KW), allowing villagers to create their own electricity supply and charge their own rates, independently of the Nepal Electricity Authority (NEA). The subsequent launch by the Agricultural Development Bank of Nepal (ADB/N) of a programme to subsidise village-level hydro schemes by upto 50% enabled people to capitalise on this new opportunity. Today, more than 650 units which provide power for agro-proosssing and a further 70 units which generate electricity have been

built privately to service village communities.

The cost of NEA's micro-hydro projects averages around $8,000 per kW produced. Village owned and ADB/N subsidised schemes, on the other hand, have averaged about $1,500 per kW. This has been possible because the village entrepreneurs and Nepali hydro companies use appropriate technologies, local labour and components manufactured in Nepal. The connection cost works out at about $160 per household for lighting and $320 to generate enough power to cook. The government would never be able to elecrtify rural households at these rates. However, where there is a determined community that is willing to pay half the costs, government investment can be a fraction of the grid connection cost.

There is no shortage of motivation in the villages. Mustang district for instance, which lies in the rainshadow of the Annapurna Himal on the Tibetan plateau at a height of 3400m, offers a particular challenge for hydro schemes as water is scarce and irrigation is the first priority for water supply. Nevertheless, a number of successful hydro schemes have already been installed.

Micro-hydro engineer Bikash Pandey surveyed many of these sites some four or five years ago. According to Pandey, the drive and determination shown by these communities is quite remarkable. "When I undertook the initial survey for one of the villges, Muktinath, they insisted that I estimate the cost of the scheme there and then. After considerable discussion between the elders and the rest of the village, they told me that they wanted to go ahead. I returned to Butwel, expecting their initial enthusiasm to wane once I'd disappeared from the scene, but within three weeks, they were on my doorstep, having raised the ftill cost of the scheme, NRs 450,000. In the neighbouring village, Jhong, the community raised an astonishing NRs 192,000 within a week. When you consider that the country's per capita GNP is mere $180, the real significance of the investment becomes apparent."

Such is the drive for electrification, the nine independent companies in Nepal which specialise in building and installing micro-hydro plants are struggling to keep up with the demand. It is tempting, therefore, for Nepal's new Government to speed up the process by importing equipment or accepting foreign equipment offered as 'aid'. Government agencies are already under pressure from foreign donors to accept donations of equipment, usually inappropriate, or to buy from specific foreign suppliers in return for other goods and services. This poison pill of 'tied aid' may speed up the process initially, but will ultimately lead to disaster. Unable to compete with 'free' foreign machines, Nepal's fledgling micro-hydro industry will wither away, taking away with it the expertise needed to maintain and repair the equipment. Furthermore, in the long run, the upkeep of even 'free' imported machines will prove to be more expensive as all spare parts will have to be bought from abroad.

Attempts to set up a 100 kW hydro scheme in Sikles, a village of 250 families in the Annapurna area, have come up against this problem. Funding has been secured for the proposed scheme from USAID on the condition that all the equipment used is US-sou reed. Quite apart from the business this takes away from the local manufacturing industry, there is no equipment produced in the US which is appropriate for the local condition. And, as US equipment is unfamilier in Nepal, it is harder to repair and maintain. In Eastern Nepal, 40 off-the-shelf Japanese machines have already appeared, and there are fears that more are on the way. There are also examples of Chinese turbines in the 200kW-lMW range that have been dumped on the market for less than the price of the steel used in their manufacture.

Another example of misdirected aid is a Finnish-funded electrification scheme near Pokhara. This grid extension programme, which is being provided 'free' to the villages being wired up, costs $4,000 per installed kW, just for power distribution. A micro-hydro scheme recently commissioned in Ghandruk village cost $1,500 per kW installed for the whole scheme, from diverting the stream to putting in the light bulbs. The scheme even imported specially treated timber transmission poles from Finland, with the excuse that it prevented deforestation in Nepal. The most scandalous aspect of the Finnish scheme is not extortionate cost, but the expectations that it raises. If one village gets wired up for free, what hopes is there in encouraging another to invest time, labour and money in setting up its own scheme?

In the UK, tied aid is suposedly limited on the ODA's Aid and Trade Provision (ATP), which represents more than 10% of the total aid budget. However, much of the rest is also tied, but in a more camouflaged form. The notorious £65 million Westland helicopter deal with India, which was no more than a straight subsidy for an ailing British company, rather than a project designed to enhance the development of the country, came from the main aid budget rather than ATP. In 1986, 79% of the total bilateral aid was spent on UK goods and services, and the situation is similar for many other donor countries.

Tying of aid is not always a deliberate move to protect a donor country's own interests; it sometimes stems from a fundamental misunderstanding of what 'aid' means. In his recent book reviewing of the last 25 years of development, *Mastering the Machine,* Ian Smillie points out that technology transfer is one of the greatest wrongs in the misguided lexicon of development. "It implies", according to Smillie, "that technology is something that exists outside of society. It suggests that technology can be handed across a desk, picked out of a pattern catalogue, or shipped by jumbo jet from the North to the South along with some 'technical assistance' to get it going."Technology transfer should

mean the exchange of the capability, and the thinking behind the capability, both to enhance existing capacity and to support the recipient countries in their own design and development efforts, i.e. 'know why' as well as 'know how'. It is better to start with small initiatives and slowly build up capability. Five years ago, the largest Nepali-made turbine produced about 25 kW in power; today the same industry makes turbines which generate 250 kW. One of the mandates of the UN Conference on Environment and Development (UNCED) is to assess 'the transfer of environment tally sound technologies to developing countries'. The remit itself indicates that the process is seen to involve only one-way traffic. Unlike its largescale counterparts, micor-hydro is one of the greenest forms of energy on the planet, and hence is an obvious candidate for technology transfer. There is no doubt that micro-hydro could provide a truly sustainable power supply for thousands of communities around the world; in Nepal it has the potential to provide some 80% of the country's needs. While Nepal is way off target still, it has come a long way towards developing a decentralised system for power generation. However, its success and sustainability is dependent on nurturing the country's fledgling manufacturing industry.
That means saying 'no' to tied aid. If it succeeds in doing so, and frees itself from internal bureaucratic barriers, Nepal could have the last laugh as it watches the rest of the world scramble for the last of the fossil fuel reservers.
Janet Bell ITDG
Hydronet 1/92

GEOTHERMAL ENERGY

Geothermal energy is an energy resource with cost, reliability and environmental advantages over conventional energy sources. Geothermal energy contributes to both the energy supply, with electrical power generation and direct-heat uses, and to reduced energy demand, with savings in the electricity and natural gas through use of geothermal heat pumps to heat and cool buildings. Only a small fraction of the geothermal resources are in use today. Much more could be brought on line in the short term with appropriate incentives.

What is Geothermal Energy

Geothermal energy is renewable heat enery from deep in the earth. Heat is brought to the near-surface by thermal conduction and by instrusion into the earth's crust of molten magma originating from great depth. Ground water gets heated to form—hydrothermal resources—naturally occuring hot water and steam. Use of hydrothermal energy is economic at a number of high-grade sites. Hydrothermal resources are tapped by existing well drilling and energy conversion technology to generate electricity or to produce hot water for direct use. Earth energy is used by geothermal heat pumps. Hot dry rock, magma and geopressured geothermal energy have enormous potential, but cannot be economically developed without the benefit of further R&D.

For generation of electricity, hot water, at temperatures ranging from about 300 F to more than 700°F, is brought from the underground reservoir to the surface through production wells, and is flashed to steam is special vessels by release of pressure. The steam is separated from the liquid and fed to a turbine engine, which turns a generator. Spent geothermal fluid is injected back into peripherial parts of the reservoir to help maintain reservoir pressure.

If the reservoir is to be used for direct, heat application, the geothermal water is usally fed to a heat exchanger before being injected back into the earth. Heated domestic water from the output side of the heat exchanger is used for home heating, vegetable drying and a wide variety of other uses.

Increases Energy Supply

Geothermal energy is here today—it is not merely a hope for the future. Approximately 5,700 MWe are currently being generated in some 20 countries from geothermal energy, and there are 11,300 MWt of installed capacity worldwide for direct-heat applications at inlet temperatures above 95 F. Since a typical nuclear power plant produces about 1,000 MWe, worldwide electrical production from geothermal energy is equivalent to that from 6 nuclear plants. (However, typical Indian nuclear plants have a capacity of 200 MWe, and hence the worldwide electricity generation from geothermal energy is equivalent to the production from 30 plants.—Editor)
As a result of today's geothermal production, consumption of exhaustible fossil fuels is offset, along with the release of acid-rain and greenhouse gases that are caused by fossil-fuel use. Today's geothermal energy use in the United State alone is equivalent to the burning of 60 million barrels (bbl) of oil each year, while worldwide geothermal energy use is equivalent to the burning of 150 million bbl of oil per year. For comparison, the entire U.S. Strategic Petroleum Reserve contains about 600 million bbl of oil.

Hydrothermal Reserves

Geothermal energy is found in many places on the earth. It is an important source of energy in several third-world countries including the Philippines, In-

donesia, Mexico, countries of Central and South America, and countries of eastern Africa. Among the developed countries using geothermal energy are Italy, Iceland, New Zealand, Japan and France, along with the United States. There is a very large geothermal resource base in the world, much of which can not yet be economically used. In fact, the resource base for the renewable energies-geothermal, biomass, solar, and wind-is much larger than the total resource base in coal, oil, gas, and uranium.

Flexibility and Reliability

Systems for use of geothermal energy have proven to be extremely reliable and flexible. Hydrothermal electric power plants are on line an average of 97 of the time, whereas nuclear plants average only 65 and coal plants only 75 on line time. Geothermal plants are modular, and can be installed in increments as needed. Both baseline and peaking power can be generated. Construction time can be as litle as 6 months for plants in the range 0.5 to 10 MWe and as little as 2 years for clusters of plants totalling 250 MWe or more.

Decreases Demand

No active technology for home heating and air conditioning is more efficient than the geothermal heat pump (GHP). GHPs are significantly more efficient than air-source heat pumps, central air conditioners and gas furnaces. GHPs use normal-tempreture earth of groundwater for heating during the winter, cooling during the summer and supplying water year around. The heat pumps itself operates on the same principal as the home refrigerator, which actually is a one-way heat pump. The GHP, however, can move heat in either direction. In the winter, heat is removed from the earth and delivered into the home of building (heating mode). In the summer, heat is removed from the home or building and delivered into the earth for storage (air-conditioning mode). On either cycle, culinary water is heated and stored, supplying all or part of the function of a separate hot water heater. Because electricity is used only to transfer heat, not to produce it, the GHP will deliver 3 to 4 times more energy than it consumes. It can be effectively used over a wide range of earth temperatures.

The GHP unit sits inside the home or building, at the site of a normal gas furnace. In a typical installation, a loop of plastic pipe is placed in a nearby vertical drill hole from one hundred to several hundred feet deep and the hole is backfilled with clay. A water/antifreeze solution is circulated through the loop and through the heat pump for removing heat from or transferring heat to the ground. There is no consumptive use of groundwater whatsoever, nor is there any contact between the solution in the plastic pipe and the earth or groundwater. Installation easily conforms to local construction and well-drilling regulations. Topical loop installations are warranteed for 50 years. In a 1988 survey of GHP buyers, 97% said that they were happy with their purchase and would buy again.

More than 100,000 electrically-powered GHPs have been installed in homes and buildings in the U.S. upto July, 1990. Additional installations are being actively promoted by investor- owned utilities and rural electrical cooperatives as a means of promoting energy efficiency and better managing demand. GHPs can cut 1 to 5 kilowatts (KW) of peak generating capacity requirement per residential installation.

Positive Environmental Impact

The competing goals of increased energy production for worldwide social development and of mitigating release of atmosphere-polluting gases are not com pi table using today's fuel mix, which relies heavily on coal and petroleum. In the United States, electric utilities now account for 70% of sulphur dioxide emissions (the main cause of acid precipitation). 33% of our nitrogen-oxide emissions (that induce formation of ground- level ozone), and 20% of the release of gases linked to the atmospheric greenhouse effect, and 50% of all nuclear waste.

Development of geothermal energy has a large net positive impact on the environment compared with development of conventional energy sources. Geothermal power plants have sulphur-emission rates that average only a few percent of those from fossil-fuel alternatives. Nitrogen oxide emissions are also much lower in geothermal power plants than in fossil power plants. Nitrogen-oxides combine with hydrocarbon vapors in the atmosphere to produce ground-level ozone, a gas that causes adverse health effects and crop loses as well as smog.

There are other environmental advantages to geothermal energy. Geothermal power plants require very little land, taking up only a fraction of that needed by other energy sources. Other land use can mingle with geothermal plants with little interference or fear of accidents.

Truly The Low Cost Alternative.

The real cost of energy is not all reflected in what we pay at the petrol pumps or in our electricity bills. Much of the true costs of energy, using today's fuel mix, are hidden. If the cost of corrosion damage, health impacts, crop losses, radioactive waste disposal, military expenditures to protact foreign energy sources, and direct economic subsidies to the fossil-fuel and nuclear industries were totalled and added to the energy bills we see, the price would astound us.

The answer to decreasing the true cost of energy is not to hide part of the cost but to alter our energy-use patterns and fuel sources to bring in much more renewable energy and conservation. If we changed our methods of utility regulation to require integrated-resource planning with all environmental and other hidden

energy costs explicitly accounted for, it would be possible for utilities (electricity boards in Indian nomenclature—editor) to use more renewable-energy resources economically. Our total energy cost would decrease and we would have a much cleaner environment.

Accelerated development of renewable resources and conservation are the lowest-cost options in some cases, even with the hidden subsidies for the conventional energies.

If hidden subsidies were made visible in energy pricing, geothermal energy would be seen for what it really is—the energy bargain of the century.

For more information, contact the Geothermal Resources Council of the University of Utah Research Institute.

SUN DAY 1992 Bulletin

Nuclear Skeletons Begin to Bark

Reactor operation like the operation of any other complicated piece of machinary is both fairly simple and hellishly complex. In normal situations—which is most of the time, routine tasks have to be performed. These are straighforward and any technical person can be instructed to do them. It is only when the situation becomes for some unknown reason abnormal, that the importance of rigourous training becomes apparent. The 155 operators associated with the Dhruva and Cirus nuclear power reactors at the Bhabha Atomic Research Centre (BARC) at Trombay, who went on strike for more than a fortnight have once again brought into highlight the extraordinary dangers posed by the BARC establishment to the city of Bombay. The following article also demonstrates the total disregard of safety norms displayed by the nuclear authorities.

In the words of the reactor operators, the attempt to rescan Dhruva with a makeshift crew of engineers and inexperienced technicians which was tried by the BARC establishment in an effort to break the strike was akin to "the nuclear power establishment playing with an atom bomb."

Standing instructions stipulate the presence of a minimum of ten qualified operatoes at any given time, whether the reactor is operating or not. In an attempt (ultimately successful) to break the strike, the BARC establishment, used a makeshift crew of two engineers, one trainee engineer and technical personnel from other parts of BARC.

According to the striking operators, the engineers were managing the control panels while the rest of the technical staff were deployed at various places in the plant to merely act as watchmen. "While they can read temprature and pressure gauges, they are not in a position to interpret them. They do not know how to stop or start operations, they have no practical experience. There are so many areas of this large plant that nobody is watching. The working conditions of a reactor are completely different and cannot be compared to other BARC operations," the operators said.

Elaborating on a worst-case scenario, association members pointed to the possibility of a power failure and the immediate need to keep the cooling system functioning. While there is a system of automatic restart, there is chance that certain isolated valves remain closed, affecting vital linkages. Maloperation by an unfamiliar operator could compound the situation. Failure to act within seconds to keep emergency lines working, could result in the reactor going out of control.

The fight to get official recognition of the BARC High Flux Reactor Operators' Association is held to be a means of collectively drawing attention to the violation of safety standards to which reactor operators are routinly subject. The association says individual grievances, recorded since 1972, have been consistently ignored and complainants have been victimised.

The demand for recognition of their association and access to independent redressal under the Industrial Disputes Act is hence an immediate objective, it was explained. Under the present system even the officially-recognised unions have no representation on the Atomic Energy Regulatory Board.

This is perhaps for the first time in recent years that staff associated with reactor operations have revealed details of their functioning, though on conditions of anonymity.

The association has highlighted specific instances showing how safety and health of reactor operators is being jeopardised. The AERB has confirmed these incidents, but maintained that radiation exposure is within "permissible limits."

On October 31, 1989, when the reactor was shut down, N.S.Maikar, an operator, was instructed by the Reactor Superintendent, R. Chowdhury, to enter the 'Loop Room', a shielded area with a strong radioactive field, to 'exercise (open and shut) the valves'. The reactor cannot start

up unless this room is first locked with a master key. When the reactor is shut down, entry of personnel and the time they spend in the room is determined by Reactor Health Committee. The usual practice followed by RHC is to permit five minutes per person, exposing him to a 'permissible' radiation dose of 50 millirem at a time.

By accident Malkar's presence in the shielded room was overlooked, and the steel door, with concrete shielding of one foot thickness, was locked. The job had taken around ten minutes as operation of the valves preoved to be difficult. Meanwhile the reactor was turned on with power generation of ten MW. Failing to draw attention by banging on the door, Malkar finally managed to attract the control room's attention when he tripped the reactor by switching off the main coolant pump.

Although he was locked in the room for 20-25 minutes, RHC told Malkar that he had only received a dose of 10 millirem. It was also claimed that his detector, which indicates individual radiation dosage, was found faulty. Malkar has alleged irresponsibility and violation of safety norms by the authorities, holding that he was subject to a higher dose of radiation, and was not sent for a medical check up because the matter was sought to be suppressed. In February, he was made to fail a promotion test, as punishment for exposing this incident, the association alleged. Since this incident, a telephone has been installed in the shielded room, but it seldom works, operators said. According to AERB, Malkar was exposed to 260 millirem.

Other reactor operators, with over ten years service in Dhruva and Cirus, testified that in all these years, they hevebeen subject to only one cursory medical check up. They expressed apprehension of exposure to higher radiation usage than what is officially made out. Operators are routinely subject to high radiation risks as they are forced to enter the shielded room when the reactor is running on low power, less than 1 MW. in order to check the Failed Fuel Detection System. Failure of the cladding on the aluminium rods results in contamination of the coolant on contact with the ura nium.

Although this failure is detected on a graph in the control room, its excat location has to be checked by physical intervention. Such incidents are reported on practically every alternate shift. Organising resistance to this risk negligence of which violates international safety norms, led to the suspension of Chacko Jacob, the general secretary of the association.

Radioactive water was found leaking from a corroded pipeline between Cirus and Effluent Treatment Plant. The leakage was however discovered only after another pipe carrying sea water got ruptured, and contract labourers were brought in to dig the area. Reactor operators reported high radiation contamination of their clothes detected by monitors, thus drawing attention of RHC to the source. They found the radiation background to be 10 millirem per hour, it was reported. The association said it was not aware of measures to decontaminate the contract labourers, or efforts to trace where the excavated soil in that area has been dumped. AERB confirmed that the incident occured in December 1991, and said that "the exposure of contract workers was well within the stipulated limits."

Association members said they were concerned about the plight of maintainance workers, who are not educated about the dangers they face, and are operating without close supervision of the RHC. They cited instance of such workers operating in high radioactivity areas.

Recently, a heavy water spillage flooded the basement and reactor hall, and maintanance staff had to physically mop the area, it was alleged. Confirming this incident, AERB said in April-May 1991 that there was "a minor heavy water spillage. The maximum radiation exposure received by personnel during this work was less than 2 per cent of the limit stipulated by AERB."

Rupa Chinai
The Sunday Observer 21.6.1992

➢

Subscription Rates:

Rs. 25/- per year South Asia
U.S.$ 15/- per year or equivalent in other convertible currencies (airmail overseas)
(Rs.300/- per year if paid for in India)
Rs.250/- for life (only within India)
Please add Rs.6/- for cheques
Drafts should be drawn on State Bank of India, Valod (0531)

Anumukti Team: P.P.Baburaj, Sanghamitra and Surendra Gadekar

Subscriptions, donations, manuscripts, inquiries regarding circulation, etc. should all be addressed to:

Anumukti
Sampoorna Kranti Vidyalaya
Vedchhi, Dist:Surat, 394641 INDIA

Please do not send cheques or drafts addressed to Surendra Gadekar

Published by S.Gadekar for Sampoorna Kranti Vidyalaya and printed at The Parijat Printry. Ahemedabad

PRINTED MATTER **BOOKPOST**