ENERGY

The Danish model

Bent Sørensen, a physicist at the Niels Bohr Institute, offers one of the most carefully derived comprehensive energy schemes yet proposed, in an article in the July 25 SCIENCE. Though it applies directly only to Denmark, the scheme includes a detailed analysis of energy choices that will face all industrialized nations.

Sørensen's thesis is that "the improvement of living standards (basic needs and luxury) constitutes a diminishing fraction of each new unit of increased GNP per capita; the rest is spent on structural changes required by the growth itself." In other words, life isn't necessarily easier or more enjoyable in proportion to economic growth. In turn, the Gross National Product (GNP) does not grow in direct proportion to energy growth: "During the last 20 years, Europe and Japan have used only half as much energy as the United States to increase their GNP's by one unit."

Given these assumptions, Sørensen quickly draws an intriguing conclusion: Emphasis should be placed on developing those energy sources that place the largest possible fraction of the GNP "at the direct disposal of the population." In general, that means diversification and decentralization of power sources, which in turn imply greater use of solar and wind energy.

Having developed a theoretical background, Sørensen tests his hypothesis against a specific case, his homeland of Denmark. Conventional electricity production, for example, will probably range from 27 cents to 45 cents per kilowatt-hour per year over the next 25 years, depending on the price of petroleum. But wind-generated electricity would be at most 27 cents, in the Danish interior, and as little as 16 cents on the windy western coast. After making a variety of similar calculations, the author concludes that with known technology, solar and wind energy are already "economically feasible" in this cloudy, chilly country, and that beginning to install them immediately would involve additional social benefits. Unemployment, for example, could be eased by the great public works project that would be involved in building the giant windmills.

Geothermal prospects rising

Lawrence Livermore Laboratory has become a leading center for geothermal energy research in the United States. Two recent LLL reports indicate progress toward creating a new high-temperature, high-salinity power plant in the Salton Sea Geothermal Field and analyze the potentials for nonelectrical uses of geothermal energy throughout the world.

The first exploratory geothermal wells in California's Imperial Valley were drilled in 1927. In the last two years alone, 12 new wells have been drilled by a variety of groups, and several power generation plants are now in operation.

The current thrust of LLL's work, sponsored by U.S. Energy Research and Development Administration (ERDA), is to design a 10-megawatt demonstration plant for the Salton Sea area of the valley, to begin operation in 1979. This area presents particular problems because of the very high temperatures and salt content of its brine.

In reviewing worldwide prospects for nonelectrical use of geothermal energy—principally heating and cooling of buildings—LLL scientists reported to the Second United Nations Conference on Geothermal Resources that prospects look very good. They find "no technical impediment to drilling," and a "very favorable" economic picture that should allow geothermal energy to "compete favorably" with oil and gas. They recommend further work on the environmental problems of disposing of the brine and a clarification of laws pertaining to ownership.

NUTRITION

Space age cheese: Blue no longer

Cheeses are made by molds and bacteria. Just about everybody knows that. But not everybody likes to be reminded of that fact while they are eating cheese. Some people, for example, pick the blue hunks from blue cheese—not exactly gourmet behavior, but each to his own culinary quirks.

After noticing such behavior at a party one night, a University of Wisconsin nutritionist set out in 1948 to create a blue cheese mold that isn't blue. He zapped mold cultures with ultraviolet light, and created a mutant organism that lacks a gene for color but that can still ferment milk into a palatable cheese.

Nutrition scientists Howard A. Morris, Elwood Caldwell and others from the University of Minnesota have since learned how to make a standard, high-quality blue-cheese-flavored white cheese with colorless mold. And it soon may be commercially available. The cheese is called "Nuworld" since, Morris explains, it was created scientifically in the New World rather than discovered accidentally in the Old World. The University of Minnesota process is being investigated now by a large dairy company (Morris declined to name it) and the company will decide soon whether or not to produce Nuworld commercially.

Will people buy an all-white blue cheese? Morris thinks so. In fact, he says, "people are clamoring for it." The University of Minnesota nutrition department makes 300 to 400 Nuworld cheeses at a time now, he says, and sells them for $2 per pound, pre-paid. Besides, he says, some people like a cheese change-of-pace from time to time, and like the idea of a "space age cheese," especially without the little blue reminders of mold and bacteria. "I guess they figure what they don't see won't hurt them," Morris says.

Winged bean: A protein messenger

A little-known tropical legume with a large, winged pod holds promise for preventing and treating protein deficiency. *Psophocarpus tetragonolobus*, the "winged bean," may become the soy bean of the South, the Hermes of the hungry, according to a National Academy of Sciences report. Its pods, tubers and leaves have a high vegetable protein content, and with proper development, may help to supplement protein-poor diets in Central and South America, the Caribbean, Africa, Oceania and West Africa. Soybeans grow poorly there, and the usual staple crops—yams, taro, cassava, and potatoes—are so low in protein (one to two percent) that when eaten exclusively, lead to kwashiokor (protein-deficiency disease).

The winged bean came to the Academy's attention during a study of underexploited tropical plants made in 1974. The NAS found it is now grown mostly as a backyard crop in Papua New Guinea and Southeast Asia. Massive leguminous root nodule systems fix nitrogen for incorporation into plant protein, and the plant parts are remarkable for their high protein content: the edible, immature pods have about 2 to 3 percent protein; the seeds from mature pods contain 30 to 37 percent protein by dry weight (this is comparable to soybeans); the tubers contain 12 to 15 percent protein (uniquely high for a storage root); the leaves contain about 6 to 15 percent protein and even the flowers, sometimes eaten in salads, have about 6 percent protein. Happily, most people find the plant parts tasty, the report states.

The large, winged pods and sweet potato-like tubers are borne on a tall vine, which must now be supported by stakes during growth. But research toward selection and improvement of winged bean varieties (as recommended by the NAS may make possible the large-scale cultivation of dwarf and erect plants, and thus the broader availability of this source of indigenous tropical plant protein.