

THE "ENERGY TRANSITION" IN A MARKET TOWNSHIP AND ITS ENVIRONS ON AN ISLAND IN SOUTHERN THAILAND¹

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Introduction

The broad outline of the evolution of the sources and uses of energy in human society is by now well documented : it could be characterised by five basic traits :

1) From a low to a high per capita use of energy (Brown, 1976 : 1-5, Cook, 1976 : 165-7) – or, what Cottrell (1955) in his pioneering work called a transition from low-energy to high-energy societies.

2) From ethno-energetic to extra-somatic auxiliary sources of energy (Ruyle, 1977), i.e. from the use of human muscle-power to the use of sources of energy external to the human organism.

3) Within the category of auxiliary energy systems—from low-intensity to high-intensity sources of energy, e.g. from wood, charcoal and water or wind power, to coal, gas, oil and electricity, and eventually atomic power (Schurr & Netschert, 1968 : 45).

4) From renewable energy sources, such as wood and other vegetable materials, water and wind power, to non-renewable, sources, such as coal, gas and oil.

5) From local energy sources to sources which originate from outside the local economic system—in the national, regional and eventually even global energy system (Haefele & Sassin, 1979).

This evolutionary process is a universal one, repeated in its general outline everywhere on the globe; it is presently most intense in the so-called developing countries. However, the process is not everywhere exactly the same. Bennett's (1976 : 123) words concerning human ecological evolution are equally valid when applied to the evolution of human energy systems :

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1. This paper summarises part of the findings of a longitudinal study of an island community in southern Thailand, the first stages of which were conducted in the summers of 1981 and 1982; it is to be continued. Thanks are due to Mr. Damrong Danayadol, for his assistance in the field, and to the Harry S. Truman Research Institute for the Advancement of Peace, at the Hebrew University of Jerusalem for financial support.

"The process is characterised by both broad unidirectional evolutionary trends and by evolutions or histories of specific human populations that may or may not exemplify the sequences demonstrated by the evolutionary pattern" (Bennett, 1976 : 123)

Following Bennett, I suggest to term the general evolutionary trend "energy transition". But contrary to the tendency in the literature, I suggest to focus, rather than on the general trend, on its specific variations found, under different circumstances, in concrete local situations. Such an approach will not only yield information on specific forces accelerating or impeding the general trend, but also make it possible to distinguish specific types of processes within this general trend.

A search of the literature revealed few studies of the energy system of local communities in Third World countries; only a handful of these deal explicitly with the energy transition or with specific aspects of it. It was this scarcity of studies which induced me to write this paper, even though I am not an expert in energetics and lacked the facilities and technical knowledge to collect data on energy flows and caloric inputs and outputs while in the field.

Detailed studies of local energy systems were undertaken primarily in communities not yet seriously affected by the penetration of modern energy sources. The best known among these is probably Rappaport's (1971) work on the Tsembaga of New Guinea. Revelle's (1976 : 969) statement, relating to rural India summarises well the nature of the energy system of such communities :

From an energy standpoint, rural India can be thought of as a partially closed ecosystem in which energy derived by people and animals from the photosynthetic products of plants is used to grow and prepare human food, which in turn provides an essential energy input to grow more food, and so on in an endless cycle." (Revelle, 1976 : 969)

The opening up of local energy systems has been discussed from two essentially complementary perspectives : pressures put upon 'traditional' energy sources, in particular firewood and other organic material (Fleuret & Fleuret, 1972; Briscoe, 1979); and the local impact of the introduction of new sources of energy, such as fuel and conserved foods (Kemp, 1971) or electricity (Hayes and Bello, 1979, Mihalyi, 1977); another variant of such studies focusses on the consequences of infrastructural innovations, such as the construction of new roads, which facilitate the penetration or dissemination of new energy sources in the community (e.g. Hong and Lee, 1977, Chatty, 1980).

Whatever their specific contribution, however, none of these studies puts the problem of the energy transition into a broad comparative and theoretical framework. Rather, they limit themselves to a careful analysis of the changes occurring under particular circumstances. With a view to create such a framework, I formulated four general problems concerning the "energy transition" on the local level :

1) The pattern of introduction of new energy sources and of phasing out of the old ones : what is the time span of the transition, which ecological and socio-economic groups are first affected by it and which last, what accelerates or impedes the process, to what extent do new and old resources co-exist, creating an "energy dualism"?

2) In which order and in what intensity do the new sources penetrate the major sectors of the local economic system—production, transport, household, consumption, etc. ?

3) what are the principal mechanisms through which the new sources of energy are introduced and disseminated in the community : are they introduced spontaneously by local inhabitants or is their introduction and dissemination sponsored from the outside? To what extent is the introduction of new sources a reaction to the depletion of old ones, or the consequence of initiatives to improve and modernize the local economy or life style ?

4) What are the actual—vs. the expected—ecological, economic, social and cultural consequences of the introduction of new sources of energy in the community? How did it affect the local opportunity structure of the various groups in the community (Cohen, 1977, and forthcoming), and how did they respond to the changes?

These problems will be examined on the basis of data collected in the course of an anthropological survey of social change in a single community—the market township of Talat Maphrao and its environs in southern Thailand.²⁾

Talat Maphrao and its Environs

Talat Maphrao is located on Ko Lek, an island of 247 km² and a population of about 32,500 (1977). Its economy is based on small-holder coconut plantations, a few other branches of agriculture and, in recent years, tourism (Cohen, 1982, 1983). Coconuts are the major, and were until recently the only, cash-crop of the island. The Island's traditional economy is in the grip of a crisis, owing to the physical and economic decline of its coconut production (Cohen, forthcoming). At the same time, however, the national government is taking steps to develop the island's infrastructure : it constructed a modern round-island road in 1980/81, and is presently expanding the

2. For a fuller description of the community and its environs, see Cohen (forthcoming). All the names of localities are pseudonyms.

central electric power supply network on the island. Concomitantly, rapid ferry transportation, introduced in 1982, accelerated and improved communications with the mainland. A local air-field, intended to provide a link with the mainland, is planned.

Talat Maphrao, essentially a marketing township, is located close to the shore on the southwestern region of the island, about 17 km from Golden Bowl Town, the small island capital. Talat Maphrao encompasses less than a hundred households, but it is essentially an urban, rather than rural settlement; it is surrounded by nine Thai coconut growing villages and Ban Malayu, a Malay fishing settlement. The total population of the township and its environs is about 3,000, living in 440 households (1981).

The township served for most of this century as the market and service center of the southern region of the island. The local inhabitants were primarily Chinese traders, but as many of these gradually migrated to the mainland, Thai villagers moved into it; the township is at present a mixed Chinese-Thai community. With the recent decline of the coconut trade, much of its traditional regional importance has been lost, but it still features a few dozen stores, and various services such as coffee-shops, restaurants, clinics, an elementary school and a cinema. Save for two small wood-mills there is no local-industry. Most inhabitants own coconut and other plantations in addition to their urban occupations and a minority lives exclusively off agriculture. A recently developed tourist beach, with about a dozen locally-owned and operated small bungalow resorts (Cohen, 1982, 1983) is located nearby.

The surrounding Thai villages are pure agricultural settlements, and except an occasional small store, possess no local services. Ban Malayu has three small stores and one or two coffee-shops, but virtually all the population lives of fishing.

The local population, Chinese, Thai and Malay, is permeated by a sense of decline, owing to the crisis in the coconut market, the gradual destruction of other branches of agriculture, such as chicken-growing and fishing (Johnson, 1981, Bangkok Post, 1982), and the worsening of the terms-of-trade of local products in comparison to the goods imported to the island. The steps taken by the authorities to develop the local infrastructure did not brighten the outlook of most inhabitants.

The Energy Transition in Talat Maphrao-A Historical Review

The traditional life style of the inhabitants of Talat Maphrao and its environs was energy extensive and based primarily on renewable local energy sources. If we take as our point of departure the energy system of the island at the beginning of this century, we find that it was based primarily on human and animal muscle, organic fuels and wind power.

The coconut plantations were worked by human labor and their product transported to Talat Maphrao either on the backs of the laborers or on buffalo-drawn carts. Buffaloes were also employed for work in the rice fields. Coconut-shell charcoal³⁾ served as the principal cooking fuel. Until World War I, sailing ships transported coconuts and other goods to the mainland or Singapore and brought in products consumed by the local population. Sailing boats also served for fishing. Only the illumination of dwellings was based on an imported mineral fuel, kerosene, but the quantities used were miniscule.

This traditional energy system began changing after the First World War. The energy transition started in the transport sector, and particularly in the field of maritime transportation. The first to go were the sailing ships and sailing boats which before the First World War plied the routes to the island and frequented Talat Maphrao's small harbor. After the War, they were gradually substituted for by steamers. This change took maritime transport completely out of the hands of the locals: while some local merchants owned sailing ships or sailing boats, all the steamers were owned by outsiders to the locality and probably also, to the island. Steamers, in turn, lost their place to combustion-engine ships after the Second World War. As the size of ships grew, the small harbor of Talat Maphrao proved insufficient to service them. With the construction of a new, long pier in the harbor of Golden Bowl Town in 1970, the local harbor of Talat Maphrao fell into disuse. The township ceased to be a link between overland and maritime transport. All mainland-bound traffic was now deflected to the harbor in Golden Bow Town, which thereby became the undisputed apex of the island's settlement hierarchy.

With the 1980's, the island's communications with the mainland were again revolutionized by the construction of a new harbor, outside Golden Bowl Town. The harbor serves the new rapid ferry line to the mainland, which not only cuts the time of the trip by half, but also transports cars and lorries and thus has a major, indirect impact on land-transport on the island. Communications with the mainland will be further revolutionized once the long envisaged airstrip, intended to connect the island with the airport in the provincial capital on the mainland, is completed.

The sphere of land-transportation began to experience the energy transition soon after maritime transportation. The first motorcar reached the island about forty years ago, beginning a slow revolution in land-transportation, which is only now, with the construction of the new concrete road, coming to its conclusion.

3. Coconut shell charcoal is produced from the inner, thin and hard, shell of the coconut; the thick, fibrous outer shell cannot be made into charcoal.

The first car on the island seems to have been a luxurious private motorcar, brought in as an item of conspicuous consumption by one of the leading families in the island capital. The first cars to arrive in Talat Maphrao and its environs, however, about thirty years ago, were small but heavy lorries, used for the collection and transport of coconuts from the plantations to the traders' stores in the township. These trucks gradually took over from the buffalo-drawn carts, so that for about 15 years now buffaloes are not used any more in coconut production, though they are still the main source of power in rice cultivation. No substantial changes occurred in the transportation of coconuts from plantation to storage since those early days of motorization: vintage Second World War trucks are still found on many farms. While in the past, however, the coconut or copra were further dispatched by ship from Talat Maphrao's little harbor, they are now transported by pickup vehicles to Golden Bowl Town, whence they are shipped to the mainland.

The pickups (*silors*), introduced to the island after the trucks, are sturdy Japanese vehicles which for years served as the only means of public transportation, as well as the primary means of transport for goods on the island's rugged roads. They provided a frequent but, until recently, slow connection to Golden Bowl Town. The new road significantly reduced the time of travel to the island capital, and apparently increased the volume of traffic. However, the road is too recent an infrastructural innovation for its impact on transportation to be as yet fully unfolded. But it already much facilitated the movement around the island of heavy trucks, which began to arrive with the recent introduction of the ferry service, and which will in all probability eventually take over from the local pickups part of the transport of goods on the island. Buses, as yet virtually absent on the island, may soon begin to take over public transportation.

The principal means of private transportation on Ko Lek are still bicycles and motorcycles. For some time in the past, the latter were taking over from the former, but in the 1970's the bicycle experienced a slight comeback with the steep rise in gasoline prices. Recently, however, as the new road neared completion there was again a sharp increase in the use of motorcycles, whose number rose from several hundred to several thousand in a few years. While motorcycles are still selling briskly, the major recent innovations are private pick-up trucks: in Talat Maphrao several such trucks were recently acquired by the inhabitants for personal or business use. Private cars are also encouraged by the new road, and while none are yet owned by the inhabitants of Talat Maphrao, they can be sighted on its main street, coming either from Golden Bowl Town or, by ferry, from the mainland.

The second main sector in which the energy transition made a significant impact was household consumption, even though here the impact came later and was less pervasive than in the transport sector.

The traditional cooking fuel in Talat Maphrao and its environs was coconut-shell charcoal, for which raw material was plentiful since the shells of the coconut are discarded in the production of copra. Most Thai and Chinese households used to prepare their own charcoal in simple ovens in their backyards and some still do. It is also available in the local stores, but is presently relatively expensive -- one kilogram costs 5 Baht (US \$ 0.25), a price which compares unfavorably with that of the newly introduced sources of household energy -- gas or even electricity.

The main transition in the field of cooking fuels was to cooking gas it started about ten years ago. Gas was quickly adopted as a more convenient and--if one does not prepare charcoal oneself--cheaper fuel for cooking. In the last 2-3 years, gas spread rapidly into most households in Talat Maphrao itself, and is presently beginning to penetrate the surrounding Thai villages; only the Malay fishermen in Ban Malayu, are unable to afford it.

The introduction of electricity to the island went through several steps, which can be well illustrated on the example of Talat Maphrao. About 25 years ago, a wealthy Chinese merchant was impressed by the use of electricity in Bangkok, and brought to the township a small 110V generator for his personal use. Like the introduction of the private car, it was an act of conspicuous consumption. However, the merchant was soon approached by his neighbors and asked to sell them electric power; he expanded his generating capacity and eventually supplied 130 households with electricity--virtually all the houses in Talat Maphrao. Electricity was primarily used for illumination, but also for a few electric appliances such as irons and fans. The supply was apparently feeble and not very reliable, and limited to only a few hours a day, so people were reluctant to acquire more sophisticated appliances.

Ten years ago, the central government electricity agency took over the supply of power, installing three 210V generators. Five years later, the network was extended to Ban Malayu, where it eventually reached all households, but was used exclusively for illumination. The surrounding villages however are still without electricity. Supply of power remained limited to evening (18.00 to 23.00) and early morning (4.00-6.00) hours (during the latter period it is used for the cooking of rice). During the day there is virtually no demand for electricity since there exists no power driven machinery or water pumping equipment in the township.

With a stronger and more reliable source of power, more electric household appliances were introduced in Talat Maphrao, particularly electric rice cookers (which are quite wide-spread), refrigerators (of which there were about 10 in 1981) and

televisions sets (only 3 or 4 sets in the whole settlement). The number and variety of appliances increased significantly during the last year, in anticipation of the pending connection of the town and the surrounding villages to the island-wide electric network, which will supply reliable power round-the-clock.

The township of Talat Maphrao and, to an increasing extent, its rural environs are thus in the grip of an intensified energy transition. The locals relate to this process of transition with mixed feelings; while some see in the construction of the road and the future arrival of centrally distributed electricity a sign of progress and the coming of civilization, many reject the innovations and are suspicious of the motives of the developers. These people deny that the road is of much benefit to the locals, and claim that it was built mainly to further tourism, from which most inhabitants do not much benefit. One person argued that the principal local impact of the road consists of a drastic increase in traffic accidents (cf. Hong and Lee, 1977: 227). Even the imminent arrival of electricity is not greeted with much enthusiasm by the villagers, even though, unlike the inhabitants of Talat Maphrao, they have at present no electricity at all. While such lukewarm or hostile attitudes may well be a result of the incongruence between rapid infrastructural developments and a generally stagnating situation, they are also a symptom of the general suspicion and animosity of the islanders to the interference of outsiders in their lives, which has also been observed in other areas, and, especially, tourism (Cohen, 1982, 1983).

The Energy Transition in Talat Maphrao-A Topical Analysis

I shall analyse the data in terms of the four major problem areas outlined above :

(1) *The Pattern of Introduction of New Energy Sources into the Community and the Phasing Out of Old Ones* In general terms, Talat Maphrao and its environs experienced the general pattern of evolution of energy sources described in the introduction : from local, renewable sources of low intensity to external, non-renewable sources of high intensity. The time span of the transition was about 60 years, but it is not yet completed. The transition is most advanced in the market township, from which most of the old sources of energy almost disappeared – with the exception of coconut charcoal which is still produced and used by a few households. It is least advanced in the Thai villages, where, except in the field of land-transport, no significant changes in energy sources have yet taken place – coconut charcoal still serves as the principal cooking fuel and there is as yet no electricity and no gas. Both these new sources are, however, in the process of introduction, and a rapid energy transition in village household consumption should be expected in the near future.

Unlike in rural areas on the Indian sub-continent (Revelle, 1976 : 972; Briscoe, 1979 ; 633), or Africa (Fleuret & Fleuret, 1972, Briscoe, 1979 : 633), in Talat Maphrao and its environs there is no real "firewood crisis" : though the forests on the mountains in the interior are, like in the rest of rural Thailand, (Vanishing Forest, 1981) being rapidly exterminated, they are cut to free land for plantations, rather than for wood. Other organic material, such as the outer shells of the coconuts, which is discarded and left to rot, is easily available – indeed, the Malays of Ban Malayu, the poorest element in the population (Cohen, forthcoming) use them for fuel, as coconut charcoal becomes expensive. The rise in the price of the latter, indeed, indicates that this specific traditional fuel is becoming scarce; however, whether the recent rise in its price announces a future trend, or is merely a reflection of the acute decline in coconut production in the last few years, due to repeated draughts, cannot yet be established.

A crisis in "traditional" fuels cannot, thus, be seen as a major factor accelerating the energy transition in Talat Maphrao. Rather, two factors were primarily responsible for the recent acceleration : the government's efforts to develop the infrastructure – the road and the electric network – for reasons which had less to do with the inhabitants and more, apparently, with the demands of the army and the plans for the future development of tourism; and the demonstration effect produced in the past by the introduction of new energy sources and uses by local individuals and more recently, by the intensified contact with the mainland, through improved communications and migration (Cohen, forthcoming). There exist, however, some important impediments to the rapid diffusion of the new energy sources, particularly in the villages : the crisis in local agriculture (*ibid.*) reduced significantly the current income of the inhabitants, putting serious constraints on their ability to pay for new implements and installations. Moreover, neither the road, nor electricity serve directly the productive sector of the village economy; there is hence little "felt need" for these innovations in the villages – for example, villagers expressed very little interest and desire to have electricity installed in their houses, once the central power-network reaches their settlements.

Co-existence of old and new sources of energy can be found primarily in one sector of the local economy – household consumption. This occasionally exists within households. Some households use both old and new sources of cooking fuel – i.e. coconut shell charcoal and gas or electricity. The principal form of dualism, however, is *between* households of different ecological groups : the households in the township of Talat Maphrao, in the main, have already made the transition to new energy sources; those in the villages still use predominantly the old sources of energy.

(2) *The Order of Penetration of New Energy Sources into the Main Economic Sectors.* The sector which was first, and most intensely penetrated by the new sources of energy was transport – first at sea and then on land; here the transition was also most

thorough, eventuating in the virtual disappearance of the traditional local means of transport. Household consumption was the next to be penetrated, but has not yet been completed: it is the only sector showing marked internal dualism. The most important finding, however, is that no energy transition has taken place in the productive sector, which remains energy-extensive and based primarily on human muscle power and animal strength – buffaloes for ploughing the fields and monkeys for plucking the coconuts from the taller trees. There is no mechanization of production, there are no motor-driven water-pumps for irrigation and only a very limited use of chemical fertilizers; no industrial enterprises or mechanical workshops, save one or two small wood-mills, were established in the community. This difference between the sectors reflects the general imbalance in local development discussed elsewhere (Cohen, forthcoming) and highlights the difficulties which local inhabitants experience as they modernize their consumption and transportation, while their production stagnates and even declines.

(3) *Mechanisms of Introduction and Dissemination of New Energy Sources*
 While the concrete mechanisms by which different kinds of energy sources were introduced for particular purposes varied from case to case, a broad dynamic pattern can be discerned: the transition was frequently *initiated* spontaneously by an individual, who either for reasons of efficiency or conspicuous consumption introduced the new use, even in the complete absence of a suitable infrastructure; he was then copied by other individuals, and the new source was disseminated on a small scale. The authorities enter the picture only at a much later stage, sponsoring the large-scale dissemination of the energy source by significant infrastructural developments. This process is most clearly observable in the sphere of electricity: the introduction of electric power was pioneered by a private individual for personal use, without any encouragement or control on the part of the authorities; only some time after he had begun selling power to other households in the community did the authorities take control, but the scale of production increased only moderately; only with the future introduction of centrally distributed power will sponsored, large-scale dissemination of electricity, particularly into the villages, take place. A similar process occurred in the sphere of motorised vehicles: local individuals introduced such vehicles for personal use, without, or with only a minimal infrastructure: petrol had to be brought in in containers, since there was no gas station; roads were few and in bad repair; only with the completion of the concrete round-island road have conditions for a rapid growth in motorised traffic been created. It thus appears that while the locals spontaneously initiated and controlled the early stages of the introduction of a new energy source, its use was limited to a small scale; its large scale dissemination had to be sponsored by the authorities, since

it necessitated considerable infrastructural investments; once this stage is reached, however, the locals lost effective control over both the timing and the direction of further dissemination – e.g. when and where electricity will be introduced or when and where new roads will be constructed – which now passed into the hands of the central authorities.

(4) *The Consequences of the Energy Transition.* Since the community is still in the grip of the intensive phase of the energy transition—the new road has just been completed, and round-the-clock, centrally distributed electricity is only pending—no fast conclusions concerning its consequences can yet be drawn. This question indeed will be one of the principal foci of future stages of the study. Some emergent consequences, however, can already be discerned.

Before turning to these, however, a word should be said about the effects of the very process of the introduction of new sources of energy on the consciousness of the inhabitants. The island has until recently had little direct acquaintance with powerful modern technologies. The construction of the road was by far the biggest project ever undertaken on the island: dozens of bulldozers, heavy trucks and other machinery ceaselessly rumbled through Talat Maphrao and other settlements; a special landing quay for ships bringing in equipment and raw materials was constructed on Sawadee Beach. Sand and gravel were quarried on the island. Hundreds of workers, many of whom had been specially brought in from the mainland, were employed in construction work. All this must have had a considerable demonstration effect on the local population, showing them vividly both the constructive and the destructive powers of modern technology. The pending electrification process will probably have similar, though less drastic effects.

On the whole, the consequences of the energy transition on Talat Maphrao and its environs were largely paradoxical, owing to the uneven development of the various sectors of the local economy. The motorization of both sea and land transport has progressively marginalized Talat Maphrao as its harbor fell into disuse, while improved land-communications radically improved the connections and shortened travelling time to the island capital. The once important regional market township lost most of its traditional functions. Improved communications, in a context of an agricultural crisis and a growing taste for “modern” life styles induced by the mass media and the demonstration effect of innovations, encouraged accelerated out-migration; this syphoned off most of the younger generation of the Chinese and has a growing impact

on the younger generation of the Thais. These phenomena have been extensively discussed elsewhere (Cohen, forthcoming) and will not be elaborated upon here.

The introduction of new sources of energy held forth an opportunity to the locals to increase the energy intensity of the different sectors of their economy. This opportunity has, as yet, not been exploited in the productive sector by any local group; some groups among the locals, however, grasped the opportunity to modernise, at least partially, their life styles. The Chinese, who were traditionally the wealthiest elements in the population, and to some extent the Thais in the township, made use of the innovations, acquiring motor vehicles and switching gradually to "modern" household appliances and cooking facilities run on gas or electricity. However, they were not under pressure to do so, since most of them had continued access to the main traditional source of household energy, coconut shell charcoal. The Malays, however, found themselves in an energy squeeze, similar to that described for other weak populations elsewhere (e.g. Briscoe, 1979 : 633) : with no access to raw coconut shells, and the rising price of coconut shell charcoal they might have been induced to acquire "modern" cooking facilities, run on gas or electricity; however, they lack the means for such household capital investments, owing to the serious crisis in fishing, which affected them as it did other fishermen in southern Thailand (Johnson, 1981), and which is aggravated by the high costs of fuel for their motorised boats, under circumstances of small and uncertain catches. Hence they are largely reduced to the use of the fibrous outer coconut shell for fuel, which is highly inconvenient and unhealthy owing to the dense smoke produced by its burning, which forces its users to cook their food on open outdoor fires. No Malay household has as yet introduced gas or any electric household appliances. Though Ban Malayu is connected to the local power network, the use of electricity is minimal and consists mostly of a single light bulb hung in the middle of the habitation. It is important to emphasise, however, that, while no such blatant squeeze is observable among the Chinese and the Thais in the township, the squeeze there is a more subtle one : energy "modernization" of consumption and transport, without any significant change in production, puts an additional burden on the household budget, and indirectly contributes to the worsening of their economic situation, particularly under conditions of rapidly rising costs of modern energy sources; it thus reinforces the push to out-migration. The rural Thais, however, have not yet experienced the full brunt of the energy transition, except in the transport sector; this will only be felt with the electrification of the villages and the dissemination of cooking gas.

The new sources of energy and the provision of the infrastructure for their dissemination, creates the conditions for a future large scale development of tourism. This could conceivably lead to a retention of part of the labor force which would otherwise leave the island. However, as my earlier study showed (Cohen, 1982, 1983), tourism, at least in its present small-scale form, had an only infinitesimal impact on employment in the area of Talat Maphrao. If and when large-scale tourism enterprises establish themselves, they might provide some additional employment – but at the price of new social and cultural problems.

Conclusions

What can be learned from our admittedly limited data on the energy transition in Talat Maphrao and its environs, on the comparative problem of variations within the general evolutionary trend in the field of energy, presented in the introduction? The evolutionary trend has been fully replicated, in its general outline; but an important point should be noted: in the core industrial countries, such as Britain and the U.S., the energy transition impinged first and foremost in the production sector, with the other sectors following suit (Cook, 1976: 185-6); in Talat Maphrao, which is by all accounts an extremely peripheral community, the productive sector was the *least* affected by the transition. While this may be a consequence of specific local factors, it still raises an interesting hypothesis, well worth of further examination: namely, that, as the energy transition spreads out from core to peripheral areas of the contemporary world, its primary impact is deflected from production to transport and household consumption. The rationale for such a hypothesis is that the original energy transition in the core areas has been self-generated or auto-centric. In peripheral areas, however, it is normally exo-centric – i.e. sponsored from the outside, and in particular by the regional and national authorities. The locals do not have to pay for the infrastructure for the new sources of energy, and their introduction thus does not presuppose a revolutionary growth in local production. Moreover, the locals find it easy to adopt the “modern” life styles, the dissemination of which is made possible by the new sources of energy; but they find it much more difficult – owing to the absence of capital resources, know-how or initiative – to adopt new methods or new branches of production. Paradoxically, then, they voluntarily take on an additional economic burden, which puts a squeeze on their resources and increases their dependence upon external factors, without much improvement in the structure of their local economic opportunities. This at least partly explains the often ambivalent, and sometimes hostile, attitude of the inhabitants to the infrastructural innovations.

The consequences of the energy transition in Talat Maphrao and its environment put into question the benefit and indeed, the reasonableness of the rapid, sponsored introduction of modern, external sources of energy into marginal communities and point to the necessity for Third World countries to pay more attention to alternative, small-scale, locally available sources of energy to supply their rural energy needs. In this study, at least, not the slightest cue has been discovered that anybody pays any attention to these sources or proposes alternative policies to resolve the emergent energy problems of Ko Lek or other marginal areas in Thailand.

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