Economic Theory and an Update on Electricity Deregulation Failure in Sweden

*By Ferdinand E. Banks**

Abstract

The deregulation of electricity has failed in Sweden. Since the beginning of the deregulation *experiment*, the trend price of electricity has increased much faster than the consumer price index, especially during recent years. More important, because of (1) the lack of investment in domestic generating (and perhaps transmission) facilities by Swedish power companies, (2) the questionable strategy employed by these firms to manage hydroelectric reserves, (3) increased and to some extent irrational energy taxes, and (4) the beginning of nuclear disengagement, households and businesses are vulnerable to a prolonged spike in electricity prices. Everything considered, the recent history of the Swedish electricity sector – and particularly that of the overpraised Nordic Electric Exchange (i.e., Nord Pool) – should be considered a wake-up call instead of an example.

The first Nordic country to initiate reform in the electric sector was Norway, in l991. Next was Finland, in l995, Sweden in l996, and finally Denmark toward the end of l999. The government of Iceland does not seem to have committed itself on this subject.

The exact theory behind the proposed deregulation – or restructuring as it is usually called in English speaking countries – is difficult to pin down, since Norway and Sweden already had the lowest cost electricity in the world; and although various taxes and levies have resulted in substantial differences between the market price and the cost of power, Swedish and Norwegian households (and probably most businesses) were still favored as compared to their counterparts in neighboring countries, including those on the other side of the Baltic who now enjoy a growing access to Swedish power. There was, however, a significant belief among decision makers that switching from regulation to competition would bring significant efficiency gains, including lower consumer prices. Among other things this provoked a desire to widen the market for trading electricity. Exactly what effect these new arrangements could have on final consumers in Norway and Sweden was not spelled out in detail, but it was repeatedly claimed that one of the purposes of deregulation was to shift risk from consumers to producers and investors.

At this point readers should make some effort to understand the significance in Scandinavia of the "taxes" and "levies" referred to above, since these are often overlooked in the mainstream discussions of restructuring. As Braconier (2003) recently pointed out, during a period in which the price of electricity in Sweden, before the addition of taxes, is extremely high for the time of year, various taxes and levies have tended to increase this price by more than l00 percent. This is not a healthy arrangement for a country whose overall standard of living is at least partially based on inexpensive electricity. Because of their external commitments – e.g., the enormous direct and indirect costs of belonging to the European Union (EU) – the Swedish government apparently feels that these and similar taxes are essential.

What especially needs to be kept in mind is that the matter of risk management – which the Yale economist Robert Shiller calls the primary subject matter of financial economics – is much more complex in electric markets than in most commodity markets. One reason is that the electricity sector per se is more complex, as was recently demonstrated in Brazil and North America! Moreover, it was not made simpler by restructuring, since almost everywhere this process has raised issues of gaming, market power, price spikes, reliability in distribution networks, and congestion that are not readily understood by persons without both a technical and economics background, and which have not always been successfully addressed even when these issues are understood perfectly.

At the International Association for Energy Economics (IAEE) meeting in Prague, a colleague from New Zealand suggested that there should be little difference between risk management procedures for natural gas and electricity, while there are researchers who apparently believe that a market for electricity derivatives (i.e., futures, options and swaps) can function more smoothly than one for natural gas. As it happens though, gas can be stored in a conventional manner, and so although its price volatility is much larger over short and medium time intervals than for items such as oil and and various financial assets, it is still well below that of electricity. What this intimates is that while sophisticated risk management techniques are an essential element of restructured electricity markets, there is plenty of evidence indicating that even in the long run, their availability on a large scale cannot be taken for granted.

In what follows, no attempt will be made to describe the exact structure and mechanics of the electricity derivatives markets in Sweden or anywhere else, but instead attention will be focussed on various issues associated with these markets. One of the most important is the attempted marginalizing of the long term contracts for physical electricity that are traditionally used to minimize risk on the wholesale (i.e., generation) side of the electric market. Instead, the ambition was to construct a system in which financial instruments in the form of exchange traded futures and options would be at the center of risk managing efforts. This is an extremely important objective, because it suggests that if generators could readily hedge against unfavorable outcomes, they might find it profitable to furnish the expensive power plants needed to meet a rising demand without consumers having to endure

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destructive price escalations. But as Budhraja (2003) points out, in an environment of uncertainty, adequate new capacity is unlikely to be constructed.

An Introduction to the Risk Management Scene

On 1 January, 1990. Sweden joined the Norwegian electricity exchange (Stattnett Marked AS) to form the first multinational market for trade with electricity, which was called Nord Pool. Four years later Finland and Denmark became members.

Initially the only trades were for physical electricity, with the goal – implicit or otherwise – of establishing a market that, as the one proposed for California, was to be mainly of the spot variety. (In Scandinavia this market is the major component of Nord Pool, and is called *Elspot.*) Exactly how much the persons who have launched restructuring across the world know about microeconomics is vague, but clearly the intention in these two regions was to treat electricity as much as possible like any other commodity. As later events in California and elsewhere have shown, electricity does not fit this description, since in a large part of the world it is even more important than oil, which many observers insist is the most important commodity of all times. In the words of Budhraja, "electricity is the lifeblood of the digital economy".

Under a (Walrasian) competitive scheme, consumers could contact an auction-type spot market (e.g., Elspot) and buy as much electricity as they desired for delivery at any time, to include immediate delivery, at the prevailing and visible (or transparent) price. This, of course, is unrealistic for technical reasons, and certainly is inconceivable for an item that cannot be stored for even a millisecond. Accordingly, the relevant version of an *ideal* electricity spot market became the day ahead market, which involves trading in standardized hourly contracts for physical delivery the following day. Elspot receives quantity and price bids from buyers, and offers from sellers that, under mainstream textbook circumstances, would form a market-clearing price that could be announced by the (independent) systems operator (who is a kind of surrogate for Walras' auctioneer). Here it should be appreciated that buyers are not households, but distribution companies, where these establishments and their customers form the retail side of an electricity market. Wangensteen and Holtan (1995) introduce these topics.

The modern electric grid is monitored in real time to assure that production always matches consumption, and if it turns out that something prevents Elspot from obtaining a supply-demand equality, the systems operator can turn to a balancing (or regulation) market where suppliers bid the quantities that they are prepared to offer at various prices**,** but at a very short notice! This has been called a "spot market at the margin". Bergman (2002) provides some useful insights into these and related matters, and among other things points out that the large hydroelectric installations in Norway and Sweden facilitate adjusting to variations in demand. This is probably because of the ease with which they can be switched on and off.) In the case of Scandinavia, part of the balancing mechanism appears to be managed by or associated with the segment of Nord Pool called Elbas, which operates with a two-hour time frame, as well as a facility that is unambiguously titled *Balance Service*, which operates in real time. Participants in the balancing power market must respond to notification of the need to adjust their production or demand within 15 minutes. As orignally conceived, the accessibility of these facilities should put the systems operator in position to designate an *equilibrium* (i.e., market clearing) *price* which ensures that transactors on the demand side of the market can buy the electricity they require from profit maximizing sellers in every minute of every day of the year.

Just now, approximately 30 percent of the electricity consumed in the Nordic countries is traded in one form or another at Elspot, with the rest being supplied by an exterior bilateral market in which contracts are signed for a period of a few days up to several years. Strictly speaking, these are conventional forward contracts, with Nord Pool providing a clearing service for these bilateral transactions. This might also be the place to note that in Sweden, generation and supply (or billing, customer relations, etc.) are unregulated, while transmission and distribution are considered natural monopolies.

In your microeconomics text, there might be a passing reference to a forward market adding its advantages to the spot-type market mentioned above, however the non-transparent bilateral arrangements referred to are hardly likely to play a prominent role in the mainstream books and lectures used to describe bona-fide competitive markets to undergraduate economics students. The same can be said about the forward contracts which are handled at Eltermin, but which are conventional forwards only in that deliverability is specified. (They are standardized, which is unusual for forwards, and do not require any physical delivery, which is also out of the ordinary for forwards).

These forwards have been designated *week-ahead* (or *some-time-period-ahead*) assets which hopefully can be traded in an exchange, and which unfortunately are confused with futures by many observers. (The futures contracts on Eltermin, however, are settled daily, while the forward contracts are settled at the end of the contract period.) As for standardized futures and options of the kind that were examined in your finance courses, these are also available and an impression has been given that they have attained an importance at Nord Pool which they definitely lack elsewhere, but I happen to be skeptical about this – especially when I hear talk about the availability of futures with maturity periods of up to 3 years: futures contracts with maturities of greater than a few months tend to be highly illiquid. There is also a swaps – or contracts-for-differences (CfD) – market that recently came into existence, but strangely enough does not appear to have achieved any momentum. As an outsider, it appears to me that restructuring has increased the complexity of the electric market, although I recognize that without these proposed addendums, a restructured market runs the risk of losing its credibility.

Initially, trade in forward contracts took place for both base-load and peak-load power, but trade in the latter could

not be sustained, and so these contracts were abandoned. (Base load power is power that is always on the line.) In looking at the situation in the United States at the time when I was preparing my energy economics textbook, NYMEX futures contracts were only valid for on-peak periods, which covered approximately 4416 hours of the year out of an annual total of 8760. Similar dispositions prevail in Australia, which suggests that futures (and in the case of Sweden quasi-futures) will have a difficult time being accepted as the ultimate hedging instrument.

In Scandinavia, forward contracts that have some of the characteristics of futures contracts and CfD were necessary because most Norwegian and Swedish power companies were uninterested in the marking-to-market procedures, and possible margin payments, that help to define a genuine futures market. (Marking to market normally entails losers being held accountable on a daily basis for losses, in which case they must pay a margin in order to retain their position. Margin plays an important role in the Michael Douglas film *A Perfect Murder*, since it was the prospect of heavy margin calls that led to Mr Douglas' decision to do away with his wife.) Additionally, in Scandinavia and elsewhere, major financial players are reluctant to join this game, which generally guarantees a shortage of the kind of serious liquidity that can only be provided by prominent firms which trade to make money rather than to hedge prices.

Naturally, the original intention in Scandinavia, as in California, was that an extensive bilateral market was to be a transitory phenomenon, and orthodoxy in the form of a large-scale spot market would soon be established, but this was more easily said than done. As pointed out early by Peter Jasinski and George Yarrow of the Regulatory Policy Reseach Centre of Oxford University, "…a combination of pooling arrangements and the freedom to strike longer-term bilateral deals appears to us to offer the prospect of workably competitive and efficient outcomes in an industry unlikely ever to be characterized by anything approximating perfect competition". Shortly after this belief surfaced in the UK, and began to circulate widely among researchers and decision makers, it was only a matter of time before both the conceptual and practical shortcomings in exchange-based activities were identified. Once this happened, it was easy to detect the virtues of bilateral contracts that are negotiated in non-transparent private markets between generators and their customers.

It is necessary to reemphasize that almost from the beginning of the restructuring experiments in Scandinavia, California, and Australia, it was generally recognized (even if reluctantly advertised) that the new regime (i.e., competition) could greatly increase price risks for producers and consumers, and comprehensive efforts should be made to introduce the kind of derivatives that had been so successful in many commodity and financial markets. The assumption was that they would not only enable price risk to be satisfactorily hedged, but would increase market transparency to a degree that, on the basis of visible spot and futures prices, it would be possible to obtain a sharper insight into the expectations of market participants.

There are many arguments as to why conventional electricity futures and options should not be expected to consistently function in a desirable manner. These arguments turn on the very large price volatility associated with exchange traded derivatives, which often means an intolerable basis risk for futures, while option premiums could be extremely expensive. This has led to over-the-counter swaps – or contracts for differences (CfD) as they are usually called – becoming the derivative of choice in various electricity markets. (Basis risk quite simply can be thought of as the price going against the buyer or seller of a dereivative, who then receives a margin call from the exchange. These margin calls can be very bad news, and this is one of the reasons why power companies in Scandinavia were reluctant to utilize conventional futures.)

Simple observation immediately reveals that the lack of liquidity has played havoc with the plans of many exchange executives, and potential transactors. The most sophisticated exchange in the world, NYMEX, delisted a batch of its electric and gas derivatives about a year ago; and although the design of the electricity contract at the Sydney Futures Exchange had the assistance of a Nobel Prize winner in economics – Professor Vernon Smith – it lacks liquidity or, in the words of an exchange executive, " market depth". It has also been suggested that the troubles of the Sydney exchange can be atrributed to the absence of a population background in the tens of millions, and in this respect Nord Pool may be lucky, because Scandinavia is an extremely electricity intensive part of the world, and eventually all the countries in the Baltic region might become heavily involved with Nord Pool. In addition, the UK might increase its commitment.

There is, however, no guarantee that the trading of physical electricity is on an upward trend. Restructuring seemed to offer a greatly increased scope for trading, and it was believed in Sweden, as elsewhere, that trading could be an activity that was at least as profitable as production, but this was wrong. (As the U.S. energy giant Dynegy could testify, their trading activities caused them only pain, and one observer has called Goldman Sachs and Morgan Stanley the "last men standing" in the trading "debacle".) For *The Economist* (July 26, 2003), Nord Pool is the most liquid European electric market in that it "trades or clears" 150 million megawatt hours per month (= 150 MMWh/m); but as it happens, trading is one thing, and clearing bilateral transactions is quite another, and so this *Economist* perception is virtually meaningless.

A closer examination of this latter situation inevitably leads to the the conclusion that there is something peculiar about all this, because financial markets in the UK have usually enjoyed an enormous advantage over those of other European countries, and the shortage of both physical and paper electricity trading activity in that country – together with an inability or lack of desire to adopt the Nord Pool model – suggests that Nord Pool either possesses some unique factor or characteristic that the others lack, or the long term survival of Nord Pool may eventually require important changes in its structure and products. It was also recently

pointed out in *The Economist* that although Leipzig's 53.7 MMWh/m is small for a country of 80 million souls, it has a lively futures market. This contention should not be taken too seriously, because if NYMEX, with the most experienced and talented traders and executives in the world cannot construct and maintain a platform for large scale trading, then the continued success of Leipzig's futures operation is highly problematical.

In a private communication, Professor Robert Wilson of Stanford University questions the present trend in the U.S. where futures contracts do not specify deliverability. By way of contrast, he saw some merit in the Nord Pool arrangements where in some sense actual or potential delivery appears to play a significant role in the derivatives picture. The opinion here, however, is that if deliverability had any special redeeming features, it would also have been universally adopted in the U.S. Furthermore, in considering the development of futures markets in general, cash settlement seems to have increased in importance relative to deliverability.

At the same time, I am prepared to admit that on this last item I might have overlooked some decisive evidence. As one observer pointed out about these matters: "It's being invented as we go along. There are some serious structural flaws in these emerging restructuring power markets." It's theoretically possible then that when or if these flaws are corrected at some point in the near or distant future, things like deliverability and large-scale trading will become more important – although this is not certain.

The Conventional Wisdom and its Shortcomings

According to Larry Makovich, a director of research for the Cambridge Energy Research Associates, "The conventional wisdom is that this is a business that's moving very rapidly to a competitive structure". But then he added, "It's a very patchwork quilt. That gap is going to remain for years to come." The business to which he is referring is the power market in the United States, and there are people who are prepared to claim that instead of years, decades may be required to make the restructuring dream come true. This kind of pessimism is not very well known in the U.S. or elsewhere, and where it is known it is often not very well received; however, a great deal of the competitive structure that Mr. Makovich was referring to was predicated on the availability of inexpensive natural gas. The way the international gas market is shaping up at the present time, the vision of small scale power plants fueled by cheap gas in a highly competitive market does not appear to be especially realistic. This also appears to be true in the UK, where recently the price of natural gas spiked to a near-record high.

When the UK government passed the Electricity Act in l989, its goals included introducing full competition, reducing prices, and opening up price and risk management opportunities. Once again we are facing one of those situations in which decision makers and their advisors and experts are envisioning a platform that would eventually be dominated by exchange traded futures, since these could (in theory) generate the (visible) scarcity or efficiency prices that everyone learns about in the first course in economics, although the exact meaning of this designation is not usually expounded on. (This term "efficiency" was used earlier, and it deserves a short comment. In moving from a regulated to a deregulated system, the explicit desire was to eliminate any practices that prevented a maximum output from being obtained with a given amount of resources. One of those practices might be executives overdecorating their offices, while another might be using too much capital relative to labor. Of course, still another simply has to do with using too much labor, and in Germany this matter was addressed by removing 70,000 employees from the electric sector. Here we have a possible source of the productivity increase that many observers interpret as the kind of efficiency bonus that restructuring engenders.)

If we stick to abstract economic theory, efficiency is usually pictured as being obtainable in a world featuring atomistic consumers and very large numbers of profit maximizing producers, where utility curves (for consumers) and production functions (for producers) have the *right* mathematical properties, where there is a complete system of contingency and/or derivatives markets to hedge uncertainty, and where things like *spillovers* (i.e., externalities) are conspicuous by their absence.

As alluded to earlier, electric futures and options were not destined to enjoy a great deal of success. This does not mean, however, that it is certain that they have no place at all in the risk management picture, although informal conversations that I have had with persons familiar with the happenings at NYMEX and the International Petroleum Exchange (London) indicate that financial players in the electricity derivatives markets must learn to handle various pricing factors that do not appear when the *underlying* is oil or bonds, etc. and given the unimpressive risk-return tradeoff, they may not be willing to make the effort. Mainstream economic theory then suggests that with a shortage of transactors, we could find outselves with an extremely thin derivatives market, and the subsequent inability to hedge price risk would discourage the participation of producers. This is what has happened in Australia, where to an overwhelming extent producers have turned to hedging their price risk with bilateral contracts, mergers, etc.

That brings us to swaps, but first I want to make a comment about options. These have not received any attention in the previous discussion, but readers should attempt to comprehend that in a market where price volatility can go right off the Richter scale, option prices (i.e, premiums) could be unacceptable to rational players. Moreover, as I have noted elsewhere, electricity price volatility in l998 was so large that even contracts that were initially deep out-of-the-money imposed severe losses on option writers. Once enough of these transactors were burned, the options market was quickly reduced to a shadow of its intended size.

Interestingly enough, there are observers who feel that the introduction of various exotic options will boost trading at Nord Pool. Whether this is true or not is something that I am regrettably unable to comment on, but as long as volatility plays a similar role in the pricing of these new options

as it does in the well known Black-Scholes (option pricing) equation, options cannot be expected to be attractive to enlightened players.

Now for contracts-for-differences. At the simplest level they lock the buyer and seller into a strike price that is independent of the pool price. For example, suppose that Mr. B and Ms. S have been able to agree – usually with the help of a third party – that they want to fix a price of 80, and in the present period the relevant pool price for both of them turns out to be 75. It would happen then that if Mr. B is hedging against a high price, he pays 5 to Ms. S. On the other hand, if the pool price was 85, then Mr. B receives 5 from Ms. S (via the third party).

Nothing in derivatives theory could be easier than this. The conventional CfD market is a brokered, telephone intensive market which brings well-matched counterparts (i.e., buyers and sellers) together, and I get the impression that with Nord Pool an arrangement of this type was (or is) combined with a forward contract. In fact, if the reader thinks about it, a swap (i.e., CfD) market can be structured in such a way as to be considered (for theoretical purposes) a futures market without speculation. However, unlike many exchange-based futures markets all over the world, its outlook would not be especially promising.

Conclusions

In this brief paper I have not been overly concerned with my likes and dislikes in the disputatious world of electric deregulation. What I have tried to do up to now is to present some pedagogical work that should be available elsewhere – for instance in standard textbooks on derivatives – but for one reason or another is absent. (One of the reasons might be that the authors of these textbooks do not believe in the future of electricity derivatives.) In any event, more pedagogical efforts are required, because misunderstandings are endemic when the topics are deregulation or oil.

To see this, I can refer to a very useful paper by Losekann and Evans (2003). They say that there are "business and institutional reasons" for the lack of sufficient electric generating capacity in Scandinavia – by which they mean or should mean the lack of reserve capacity. "Demand is not strong," they say. The truth is, however, that demand continues to expand, and the cables across the Baltic will provide many new buyers. The reason for the lack of investment in capacity might be – given the arguments in the present paper – that the uncertainty associated with this investment – which is sometimes called *regulatory uncertainty* – is excessive, and cannot be adequately hedged. Of course, another reason could be that the Scandinavian power companies want profits even larger than the record profits they are now realizing, and one way to get them is to restrain the expansion of output by not increasing local productive capacity. Electricity can, of course, be imported, but (short run) marginal cost pricing will result in all domestically generated output being sold at the import price, which typically is well above the average Swedish price.

"From here in Ontario, the news is good," Professor John Grant wrote in an IAEE newsletter about a year ago. Some of us think that it was better than good, considering that only a few months later, the deregulation experiment in that province of Canada was suspended. As in California, it may eventually be resusitated, however, expensive natural gas in North America, and insufficient investment by generating companies that are managed by persons who not only have read their economics textbooks, but also understand them, should ensure that deregulation will always create problems for a large fraction of the population.

Earlier in this exposition I claimed that contracts-for-differences are becoming increasingly important as a tool for dealing with the uncertainty in electricity markets, but at the same time I mentioned that the electricity swaps (CfD) market in Sweden is in a state of disrepair. Why is this? One possible explanation is that Nord Pool forward contracts function or have functioned as a swap, or something like a swap. This I would call an ad-hoc arrangement, primarily designed for the benefit of decision makers who believe that institutions such as Nord Pool improve the quality of the electricity market, and any and everything should be done to keep its doors open.

There is probably no subject in finance that is so badly understood as electricity derivatives. One hears things about these derivatives that cannot possibly be true; however this is a situation where we should try to understand that we are dealing with an extremely important human emotion: the one associated with the belief that more money is better than less. Accordingly, these markets may never be understood properly, because it is not impossible that many electricity markets will revert to their previous regulated form at some point in the future. In fact, when I began this paper a "crisis meeting" was taking place between the industry minister and executives from the Swedish forestry industry about what the latter regards as ruinous electricity prices. (And on the basis of the clearly expressed desire by EU commissioner Mario Monti to see the level of energy taxes on Swedish industry raised by a very large amount, these meetings could become a weekly event.) Like many other alert persons, these executives can examine a plot (over time) of electricity prices and the Consumer Price Index, and immediately see that the growing gap between these two can only be due to deregulation. (This gap first emerged when Sweden became associated with Nord Pool in l991.)

I conclude by mentioning that to my way of thinking, bilateral and other forward arrangements should maintain the dominant role in electricity trading, while conventional futures and options should be minimized for the simple reason that they cannot be expected to yield the desired results. At the same time, the utility of CfD (i.e., swaps) should be more widely recognized. I can also note that Mats Leijon, professor of electrical engineering at Uppsala University, recently claimed that from an engineering point of view, competitive frictions between the wholesale and retail side of the electric market that followed in the wake of deregulation, have led to a decreased technical standard for the Swedish electrical network. Of course, from a technical point of view that net-

work is one of the best in the world – or maybe even *the* best; however, it is just as possible for it to be seriously damaged by virtue of faulty restructuring as by an accident or sabotage. In fact, this is exactly what Robert Kuttner said in the *New York Times* (August 16, 2003), where in addition he wonders why the residents of the United States are unable to recognize the damage that electric deregulation is capable of causing an indispensable service.

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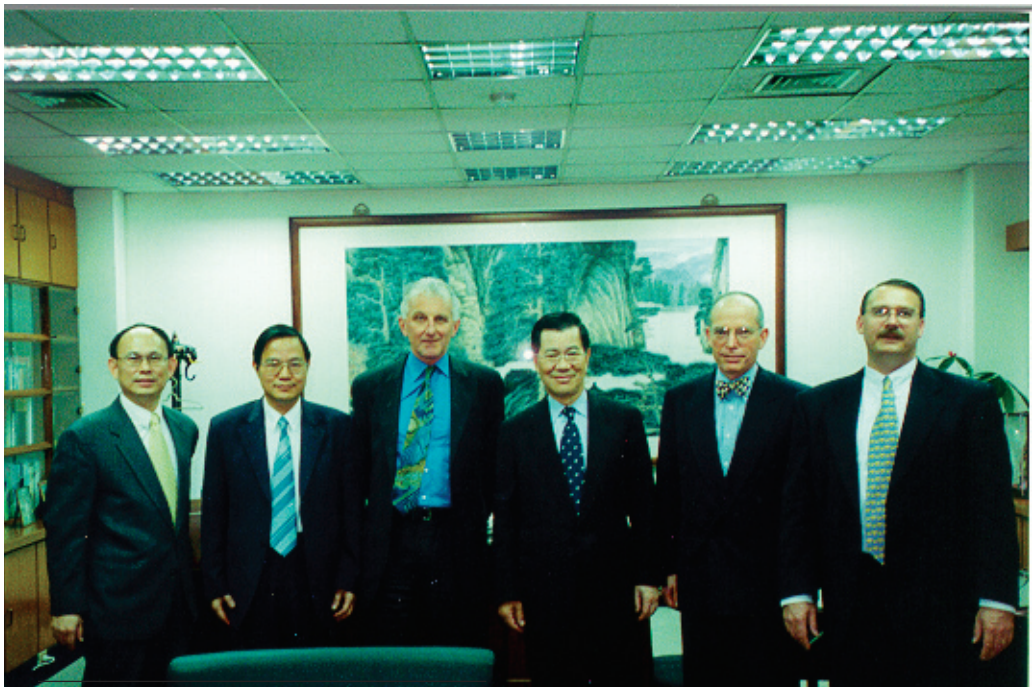
IAEE Leadership in Taipei

Plans are being made to for the Chinese Association for Energy Economics to host the 28th IAEE International Conference in Taipei, June 3 – 6, 2005. IAEE President Tony Owen, President-Elect Arnold Baker and IAEE's Executive Director visited Taipei in November. Tony Owen was one of CAEE's distinguished speakers addressing "The Transition to Renewable Energy Technologies."

The Taiwanese are rolling out the red carpet for participants of this international conference. The meeting will be held at the world renowned Grand Hotel (visit www.grandhotel.tw). Progress has been made on lining up a well balanced international program. Please visit http://www.iaee.org/en/conferences/2005.aspx to keep posted on the developments of the program and social events. You may also order a Taipei IAEE International Conference promotional CD-Rom which will showcase the conference venue, program and cultural attractions of Taiwan. We're told that all spouses/guests can be ensured of a wonderful time experiencing all that Taipei has to offer (shopping, dinning and relaxing!!).



L to R, Jeffrey Bor, Tain-Jy Chen, Tony Owen, Vincent Siew, Arnie Baker and Dave Williams