Energy Conservation and Efficiency Project

Impressions from THOMAS GRAMMIG

TA FOR THE PUBLIC SECTOR COMPONENT

TIMS performance so far concerning thermal projects has been poor. All projects have been studied and assessed for months now, with only minor tangible progress. The TIMS group members have only limited understanding of what they are supposed to do and do not have the analytical means to produce sound economic or technical analysis. Electrical projects are handled by local consultants. TIMS has so far only limited capacity to oversee consultant work.
But the use of local consultants assures an acceptable implementation pace.

For a start the TIMS group is groping after energy conservation, in an unstructured manner, because there is no data or analysis, how much energy is used in which process, which company and for which product. TIMS has never attempted to establish where in the public sector the energy efficiency is lowest. The group is unable to gather enough reliable data far that purpose, because of the perception of the group's members of the usefulness of such data. Any effort in that field should therefore utilize other people, but TIMS contacts are essential for access to such data.

All important members of the TIMS/ECEP group have been working for TIMS in various functions before. Most of the group members still give lectures to students at TIMS although they are supposed to spend all their time in the project. During a few visits to other parts of TIMS (to which I was not invited to) I got the impression that the TIMS/ECEP group did not get the best of the available staff. Most members of TIMS have ambiguous feelings about having Americans around, after been brought up by Russian academics during the last 20 years.

I did not address any of the organizational problems because I was under the impression that I should produce drawings and specs as fast as possible because we'd proceed right after that with procurement. Since it was the first time that I have done such, it took me quite a while to produce and I did not involve my counterparts sufficiently in my work. At the end TIMS had something tangible in their hands, were very glad to have it and have followed my recommendations completely, and that of course has not increased their own capabilities.

Equally Robert Erickson's efforts to convey some cogeneration expertise to TIMS did not push their present horizon much further. There is some thermal insight on part of Eng. --------, but neither he nor Dr. ------- have grasped the economic analysis of cogeneration. That was not to be expected either because Robert spend most of his time at DRTPC.
Furthermore I did not support Dr. ------ because my impression was that

advising him on his activities was not expected from me. I concentrated on individuals of the TIMS group and conveyed such basic knowledge as different fuel atomizers types, heat transfer equations etc. That helped group members individually but did nothing to improve TIMS capacity of using the individual capabilities.

Individual capabilities exist as:

-Dr. ------- (executive director): he is the only one with a sound technical understanding and a very broad base. His managerial skill is very limited. He does not plan or structure his own efforts sufficiently, nor the efforts of his group. He tends to jump from one issue to the next without waiting or reflection in between. His capacity and motivation to listen and to learn is high. Due to his strong religious faith his personal style will not change.

-Dr. ------- (technical director): his technical understanding is fair. His engineering judgement is better than egyptian standard but still weak. His strength is a broad background in instrumentation and related equipment. When he perceives a gap in his understanding he asks by his own initiative. But he overjudges his capacity. He supervises the Energy Bus activities and some of the Bus personal, not being trained in Czechoslovakia, have been trained mostly by him. The deficiencies in their own understanding of their tasks can therefore be traced to him.

-Dr. -------- (senior electrical engineer): his technical understanding is limited. His engineering judgement is average. He is willing to listen and to learn, but he does not always come forward to ask if he does not follow because it does not appear to him.

-Eng. ---------: he worked in the chemical industry for a long time and is familiar with process engineering. His engineering judgement is poor, his knowledge about encon is very limited. He is willing to listen and learn and does come forward with questions, but he does miss out some when asking (can't identify all his gaps).

-Eng. ----------: best work discipline of all good basic understanding of thermal technologies, comes forward to ask questions. He does not question data sufficiently, therefore limited engineering judgement. He advances slowly but in a solid and careful manner.

-Dr. ----------: least work discipline, very poor engineering judgement, does not ask, overjudges his capacity , tends to think and proceede very academically, Good for representation purposes

-Dr.----------: the only one with western training (PhD from London) and it shows, good work discipline, should be tested on other than editing

-Dr. ----------: good work discipline, useful previous experience in metallurgical processes, comes forward with questions and is willing to listen and learn, no experience with Encon, average engineering judgement, perceives the absence of organization at TIMS

-Eng.----------: good programmer, curious, needs a lot of help because he does not structure his learning efforts. Can not learn from a manual, needs help in getting the right information from other TIMS group members (what is needed to have him supply the computer services for TIMS " project managers ").

-Mr.--------, Mr.-------, Mr.---------, Miss ------: all very supportive and willing but need much more guidance from above, do not structure their efforts and so advance very slowly.

The individual knowledge which exists is not utilized within the group in a structured manner. For example TIMS has recently identified 3 new power factor projects. The acquisition for these projects was done by Dr.----- and Eng-----. Both are not familiar with electric projects, which are otherwise handled by Dr. -----.

Efforts to change the management culture at TIMS have so far not been successful. One of the reasons was that our understanding of assisting TIMS is US culture specific. We expect, that the group will take our advice and elaborate on it based on such concepts as responsibility, liability and billability. But their experience in taking advice is bound to a paternalistic behavior. That means based on friendship and respect. Most of the group's members come out of Egypt's public sector where personal relations between individuals from different departments shape the interaction, not the organizational requirements. This perception at TIMS (assistance can only come from somebody with a moral commitment to the common cause) is unlikely to change.

Consequently, they cannot consume MTA as a service product, only as a benevolent favor. Most of them actually understand that difference and are consequently aware that the relation with Hagler, Bailly has to be different. They are willing to approach and deal with the MTA contractor in a different mode. Probably the reason why they do not change their mode of interaction with us based on that perception, is that they are intellectually unable to formulate their need of MTA assistance in a functional manner.

That is to say, they cannot conceptualize their gaps and deficiencies both in

terms of background knowledge (thermo and fluid dynamic understanding, material properties, etc.) and regarding their work procedure (when to ask for data, what to calculate, which question to further). Furthermore, they cannot always abstract from their tasks to see whether a particular input from the MTA is relevant for that particular task or not. When this is insufficient they will and in the past have done so, ask the same question from a different angle several times. In short they do not know when, what and why to ask.

This inability to formulate and to consume MTA in an efficient manner will not be overcome in the short run and therefore must be dealt with. This leads to the need to assist TIMS in asking questions, in requesting assistance. Maybe this has to be addressed next in a plenary event at TIMS. In this session all TIMS employees should to be told that they are required to ask for assistance helping them to formulate questions to MTA, no exceptions for any one of TIMS employees.

TA for DRTPC

The M\TA for DRTPC has a very different character. All members of the group are responsive and capable of using M\TA in an efficient manner. Requests for assistance are brought forward when it is objectively needed. Furthermore it is very well taken aboard and only minor confirmation is necessary to assure that the advice was clearly understood.

The credit for the good collaboration and the speedy progress of DRTPC's projects so far, clearly goes to Ed and Dr. -------. The cooperation between them has established a clear understanding of the project's scope and tasks. Nonetheless the group needs continued assistance to foster the progress so far in order to assure a continued and significant impact of the project for the energy efficiency in the Egyptian private sector.

The individual members of the DRTPC group show strong motivation and personal commitment. The existing technical and engineering deficiencies are well understood by all and the group's members are actively trying to fill them. The capabilities in the electrical technologies is high, based on the expertise of Dr. -----. Severe gaps exist in the thermal part of the project. DRTPC has not

been able so far to recruit capable engineers. The lasts hire Mr. ------ is very motivated, his learning efforts are untiring but his gaps in theory and practice are large. For example he was not aware of the prefix "normal" cubic meters, or did not understand what dew point means. But his work discipline is high due to his former position as headmaster of an airforce training academy (rank of general). DRTPC needs more manpower in the thermal field and with more expertise.

DRTPC has 2.5 programmers with good experience with dbase, word processing, spreadsheets, Timeline and else. Dr ------ (the technical director) and two economists have a sound understanding of economic feasibility studies.

Project specific comments for TIMS activities

In the public sector five projects are pursued regarding demonstrations of thermal technologies at the following plants:
Kafr - El - Zayaat, Egyptian Copper Works, El Nasr Coke, Delta Steel and Egyptian Iron and Steel Company. TIMS work at Delta Steel was supported by R. He also worked on the cogeneration option at SIMO Paper (selected for realization) and at Talka Fertilizer (not further pursued, too large).

Kafr-El-Zayaat

A rather small plant with no influence in the Ministry of Industry and therefore starved of funds for investments. Originally build to produce DDT, it is now only using part of the original equipment to formulate imported technical pesticides. Approximately 500 TOE could be saved if the steam supply system is adapted to the present operation (mainly a modern powdered sulphur production unit). For technical proposal (small packaged high-efficiency boiler with condensing economizer and introduce them to the use of steamtraps) see the report delivered to TIMS on Oct 29, 1989 and letter HBT043.

Present status, Ed wants them to install some steam flow meters to get a better idea of their steam needs. We'll have to buy them and it will probably take another 2 month before we have any more data. The also want us to pay

for a new raw material heating room (for the pesticide drums as delivered). Their present practice of heating them before formulation is dangerous (water bath where drums are submerged and steam is injected) and limits their production.

Egyptian Copper Works

Maybe the most hilarious place in the Egyptian metallurgical sector. Very diversified production from rebar steel to aluminum and other non-ferrous metals sheets. The 50 ton open hearth furnace is a good place to start. Following other ECEP projects there, should concentrate on their non-ferrous production (particularly copper (see Foster Wheeler's audit)). The company has demonstrated capabilities for ENCON technology implementation in an earlier UNIDO project on their reheat furnace.

At the 50 ton furnace fuel consumption can be halved simply by operating present equipment professionally which is not realistically expectable. Therefore some hardware modifications can be used to induce some behavioral change especially a gas analyzer, adjustable speed motors for fans, graphite injector and a water-cooled oxygen lance (see report to TIMS from Nov 14, 1989.

Central problem with the present operation is the practice of operating the furnace without combustion air fan. The operators prefer to leave a manhole open before the checker crossover valve instead. All air entering the checker is sucked through this manhole by natural convection. Probably 30 % of the fuel therefore does not burn in the furnace due to insufficient combustion air, but in the checker itself, where due to the large volume of air leaking through the checker roof (standing on it one sees lots of large holes) combustion is completed.

The checker brickwork breaks fast due to the thermal stress and after 150 to 180 heats it has to be rebuild. Thermal stress is indicated because the bricks break into larger pieces. Towards the end of such a campaign the flow resistance of the checker becomes so large that the full power of the 200 HP ejector blower (oversized by a factor about 10)is needed to maintain suction through the furnace. Towards the end of the campaign some bricks are deliberately taken out of the checker wall to " cool " the checker.
Adding the adjustable speed motors for the combustion air fan and the ejector fan together with a gas analyzer would create some pressure to change that practice and with TIMS' influence and a lot of operator training in the plant the ECEP could probably get them to change. The graphite injector and water cooled lance would shorten the melting and refining time required per heat.

Graphite injectors are standard equipment and can be used through the charging doors. Oxygen lancing warrants a hoist arrangement through the roof which is a major modification. The only company supplying suitable lances for open hearth furnaces is Berry Metals in Pennsylvania but they provide only the lance and not the hoist and auxiliary equipment.

The original study on the furnace, prepared by the Vice Dean of Engineering at Cairo University, centers around flawed calculations and is useless. TIMS needed more than two month to write up an own proposal after additional measurements on Dec 14 to 17, 1989. Their final technical report has been delivered to Egyptian Copper Works on Feb 12, 1990. It will take Copper Works at least two weeks to read and understand. The report has some good analysis from the additional data gathered but also some mistakes. TIMS will have a meeting at Copper Works with the decision makers there and this Vice Dean from Cairo University. I anticipate that there will be a strong disagreement between TIMS and the new MTA team over the decisions taken at that meeting. Since it will take a while to establish a compromise and TIMS still does not know what specification means, it will be at least 3-4 months before procurement of equipment can start.

Since there is no automatic, of the shelf equipment for such a furnace that project is a tough one. The three other open-hearth furnaces in Egypt (one more at Copper Works and two at National Metals) are similar. Most of my time and effort in discussion with Dr.----- (TIMS project manager for Copper Works) was wasted because of his unwillingness take on any advice.

El Nasr Co. for Coke and Chemicals

The only coke place in Egypt, given strategic importance and with a very mixed performance. The coke part of the plant is Russian and we havn't studied it in detail consequently. If commingling becomes more fashionable in the wave of Perestroica there are four 25 ton steam boilers from Russia in the coke plant which could take some retrofit. Maybe the only option is to scrap them.
Part of the fertilizer operation of El Nasr produces ammonium nitrate for the military and is difficult to get access to. The fertilizer plant is all French equipment and the non-military part features a boiler house which we looked at (see report to TIMS from Feb 7, 1990). There is also a steam turbine between the high and the medium pressure steam header which is shutdown since months, and maintenance is not our objective but we havn't looked at the possibility of supplying a fancier one instead.

Egyptian Iron and Steel Company

The flagship of the metallurgical sector, site of Egypt's only four blast furnaces. TIMS wanted to modify their dolomite kiln and the medium section rolling mill, but that's all Russian stuff. Two more interesting options are their light section reheat furnaces (german and polish) where TIMS will hopefully use their Energy Bus for a detailed assessment (they feed newly retrofitted german rolling lines), and their two electric arc furnaces, which are probably the most efficiently managed ones in Egypt. But we should see whether it is not to repetitive for TIMS to work on reheat furnaces for the third time (first and second being Egyptian Copper Works and Delta Steel).

At the EAF we should investigate a scarp preheating installation (the company flares some 47 million cubic meters of blast furnace gas per month). No written detailed assistance has been given to TIMS for that one so far. Amit tries to find somebody with expertise for such in the US.

TIMS wants to add two more EAF vessels to use them alternately, one under arc the other fully charged being preheated (Dr ---------'s pet project). Other configurations are preheating in a charging vessel which should take a whole batch or half of it in one go. The company has made such trials with their present charging buckets, but without insulation of the bucket and the unsuitable bucket geometry they got the scrap only to temp 300 $^{\circ}$C. It remains also to be clarified whether the furnace off gas should be used for preheating or the blast furnace gas or natural gas or any combination.

Project specific comments on DRTPC's efforts

DRTPC is currently working on five thermal projects:
Asfour Glass Co., Arab Ceramics, Suez Cement, Cleopatra Hospital and Alu Misr Co. R. looked at cogeneration at Suez Cement (not further pursued), at Cleopatra Hospital (2nd priority) and at Alumisr (1st priority).

Asfour Glass Co.

A first feasibility study was prepared by Prof. ------ from Cairo University. The analysis pursued there has the same flaws as Vice Dean's open hearth furnace. Accidentally some maintenance engineers from Germany where there during that time and they replaced one of the recuperators which was burnt out as a butterfly valve in the combustion air inlet was closed and the handle broken, for which reason it was not visible.

-------'s conclusion was that the recuperators are ill-designed and we searched for appropriate ones in the US. After the replacement of the damaged one the performance of the existing recuperators has improved so that all the US offer we got are not viable. Unfortunately we didn't find somebody with a real fancy ceramic one.
The improvement of the recuperator performance was assessed during additional measurement of the Energy Bus from TIMS and the analysis was given to DRTPC in a letter from Jan 21 ,1990. ---- followed the calculations in detail but has not grasped all.

Leaves us with the option to use regenerative burners there or to add only a gas analyzer. I faxed to Hauck Manufacturing Co. for such burners, but their license is from England and does not cover Egypt. Amit looks for other suppliers. Still it would be a nice plant to realize some ENCON because they are comparatively well managed (export a lot of their products).

Arab Ceramics Co.

Also a rather efficient plant. So far T. and Dr.----- walked through once and the data shows it could be a good place for some waste heat recovery. OEP will do the technical feasibility work, DRTPC will have to put the economic numbers to it.

Alu Misr Co.

A not so well managed plant producing aluminum profiles featuring six furnaces all using natural gas and with only one gas meter for the whole plant. Their two furnaces melting scrap held originally 5 t in a batch each, and they have redesigned them rather rudimentarily to hold 13 t instead. We could do all sorts of things there but it would be necessary to rebuild half the furnace anyway, and that's not what the ECEP is for ?! The Energy Bus spend three days there and the plant got a detailed analysis of that data from DRTPC on Feb 11, 1990, explaining to them all sorts of things they could do themselves.

R. thought it is the best place we know at the moment to demonstrate cogeneration so we opted for that and leave the other options for the plant. Their own financial capabilities are rather good and they should be able to do it (they will build a second extrusion line ready for production in September). The Tecogen system specified by R. would replace two steam boilers supplying about 1 t/h of 2 bar steam to some anodizing baths (featuring steam traps and condensate return). The company is concerned that the Tecogen would supply only one bar steam and that might not be sufficient for the heating coils in the baths. Maybe we'll have to use a steam compressor.