Di G. Mazzone & C

SOMMARIO / SUMMARY

Disclaimer

Introduzione

Abbiamo il **piacere di comunicarvi** che all'inizio di maggio 2010 abbiamo contattato **GAMMA MANAGER** (http://www.gammamanager.com/) un' importante societa' di produzione energetica, che ci ha inviato dei documenti da pubblicare, al fine di diffondere le loro ricerche per il benessere dell'umanita'.

Ringraziamo **Krisztina Sulyok** e il **Team di Gamma Manager KFT** per le preziose informazioni che ci hanno inviato e per il lavoro che stanno facendo.

Abbiamo tradotto in Italiano solo la parte introduttiva della loro azienda, invece la parte funzionale e' stata lasciata in inglese per motivi tecnici.

Auguriamo alla Gamma Manager un sincero in bocca al lupo per lo sviluppo di una nuova tecnologia che cambiera' in meglio la vita di tutti.

Il Team di MareaSistemi

«La storia è piena di gente che per paura, ignoranza o brama di potere ha distrutto la conoscenza di un immenso valore, che in realtà appartiene a tutti noi. Non dobbiamo permettere che ciò accada di nuovo.» Carl Sagan

MareaSistemi e' stata autorizzata alla pubblicazione. Tutto il materiale e' proprietà esclusiva di Gamma Manager KFT.

Introduction

We are pleased to announce that in May 2010 we contacted **GAMMA MANAGER** (http://www.gammamanager.com/) a energy company production. They sent technical documents to be published in order to diffuse their research about the humanity welfare.

We thank **Krisztina Sulyok and Team Manager of Gamma KFT** for the valuable information (EBM Technology).

We have translated in Italian only the part about Gamma Manager introduction, instead the functional part has been left in English for technical reasons.

We wish to Gamma Manager a sincere good luck to develop a new technology that will change the life for all.

MareaSistemi's Team

« history is full of people who, out of fear or ignorance or the lust for power, have destroyed treasures of immeasurable value which truly belong to all of us. We must not let it happen again» Carl Sagan

MareaSistemi was authorized from Gamma Manager for this publication. All material is Gamma Manager KFT property.

Presentazione della Gamma Manager Kft (sviluppatori della tecnologia EBM)
FREE ENERGY

I predecessori della Gamma Management Engineering Ltd. hanno iniziato le loro attività nel 1963, a Edmonton, Alberta, Canada fornendo servizi di consulenza come esperti di costruzione di sistemi di produzione e trasporto di energia elettrica, (gas, gasdotti) in Canada, negli Stati Uniti, Sud America ed Europa.
Nei periodi di punta dal 1963 al 1980, lo staff professionale Gamma ha superato i 400 progetti con milioni di progetti cad.

Dal 1986, I successori di Gamma Manager hanno lavorato in Texas (USA), Toronto, Inghilterra e Ungheria con aziende di produzione con il fine di sviluppare la tecnologia EBM.

La sede attuale della Gamma Manager Kft si trova a Budapest, Ungheria.

Gamma ha iniziato il coinvolgimento e la formazione della gestione del Nord America, per mezzo di una ditta controllata di GAMMA Manager Kft, iniziando le attività di marketing da Toronto, Ontario.

Gamma Manager Kft ha creato con successo i mezzi per permettere la distribuzione di marketing dei prodotti

.

Più di **400 milioni di dollari** sono stati investiti nella ricerca e nello sviluppo di questa tecnologia negli ultimi 20 anni.

La tecnologia EBM (Energy by Motion) è stata brevettata in 42 paesi durante la fase di sviluppo.

Tutte queste domande di brevetto sono state fatte scadere. Comunque il brevetto principale della tecnologia EBM e' stato protetto da due punti fondamentali:

La versione finale dei brevetti sono stati applicati in 42 paesi, che rappresentano circa l'80% del PIL mondiale, il tutto sotto la protezione del copyright per un tempo indeterminato e senza limiti geografici.

GAMMA Manager Kft. Effettuera' la produzione delle macchine EBM in Europa centrale e l'Ucraina come contrattore ha gia' negoziato prezzi e quote.

Le discussioni con i produttori canadesi sono in corso per avere ulteriori unità costruite in Ontario e Quebec.

La gamma di prodotti iniziali sarà con macchine EBM dai 3 MW ai 10 MW di produzione elettrica vendibile.

Questa dimensione è specificamente utilizzato come unità di kick-start.

Sono gia' state ordinate le unità EBM più potenti che variano da 40 MW, 50 MW e 300 MW per essere installati a partire fine del 2010.

Gamma ha attualmente un folto gruppo di scienziati e ingegneri responsabili per l'ulteriore sviluppo commerciale, progettazione e sperimentazione di impianti di energia EBM, che costituiranno il nucleo iniziale della linea di prodotti EBM.

PROGRAMMA DI RICERCA EBM

Dalla manipolazione delle forze elettromagnetiche, si e' riuscito a scoprire un rubinetto nascosto dove si riesce a "spillare" energia. Il funzionamento si basa su una equazione differenziale elaborata dal professor **Li Szabo (responsabile della ricerca di GAMMA Manager Kft.. Di Budapest, Ungheria)** che dimostra, attraverso alcune manipolazioni elettromagnetiche la creazione di un sistema di produzione di energia pulita.
Alpha Institute for Advanced Study (www.aias.com _) "pagina 9, re: § 12, GAMMA).
Per accettare L'ipotesi del Prof. Szabo sull' equazione differenziale su cui si basa la ricerca, bisogna modificare le leggi della termodinamica; una vera e propria violazione del sistema.

Non è la prima volta che si mette in discussione l'inviolabilità delle leggi sulla termodinamica. L'esperimento del prof Szabo potrebbe smentire la legge in questione.

La convinzione è che se c'è qualche anomalia nella legge, la modifica rischia di fare luce sulla presunta «teoria del campo unificato" che è il principio della fisica tradizionale dal 1940 a oggi.

Nell' analizzare una particolare equazione differenziale (una formula matematica che descrive le proprietà fisiche in un determinato insieme di circostanze), **il professor Szabo ha stabilito che l'equazione non e' applicabile con le attuali leggi della conservazione dell'energia.**

In sostanza, si evince che, quando un campo elettromagnetico ha una certa “forma" matematica", l'energia prodotta dal sistema potrebbe essere più **di quindici volte quella fornita.**

Come risultato di ricerca matematica, il professor Szabo costrui' nel suo laboratorio un piccolo rotore dell' apparecchio elettromagnetico nei primi mesi del 1980 iniziando la sperimentazione dell' equazione differenziale.

(Si veda la recente conferma dei risultati del professor Szabó : “How Do Space Energy Device Work? Una frase di Einstein-Cartan-Evans Theory "da Horst Eckardt, di Siemens.

Di G. Mazzone & C

Inizialmente il rotore era troppo piccolo per fornire i risultati soddisfacenti: produzione di una modesta quantità di energia da un piccolo input di partenza.

Era sufficientemente sofisticato per confermare l'equazione in alcune delle sue parti fondamentali.

Su questo principio GAMMA ha sviluppato altri prototipi, scoprendo nuova tecnologia per la generazione di energia attraverso la manipolazione elettromagnetica.

Grazie alla sua meccanica e' possibile commercializzarlo in un periodo ragionevole, a differenza delle centrali attualmente in uso.

Nella ricerca sulla fusione e fissione nucleare, si è riscontrato che gli esperimenti su piccola scala non possono dare risultati scientifici apprezzabili per fornire dati concreti.

L'esperienza ha mostrato che per avere dati attendibili bisogna fare esperimenti con grosse fonti di energia. Per esempio, la ricerca nucleare usa ciclotroni a larga scala e sincrotroni per spostare particelle atomiche a velocità estremamente elevate e per creare alti livelli di energia.

Lo stesso principio vale per la ricerca elettromagnetica sviluppata da GAMMA's.

Di conseguenza, la sperimentazione su piccola scala dal professor Szabo ha indicato le direzioni da percorrere.

Il passo successivo e stata la costruzione e il collaudo di assiemi di rotazione di grandi dimensioni, che consentono di ottenere forti forze elettromagnetiche in varie combinazioni.
Questi sistemi di rotore, controllati dal computer, sono impiegati per svolgere test su milioni di campi elettromagnetici diversi tra loro. Queste prove sono state eseguite per confermare o modificare l'equazione differenziale, il tutto, grazie anche, al contributo di altri ricercatori.

GAMMA si e' appoggiata a diversi gruppi di ricerca, principalmente in Canada, in Texas, USA, Regno Unito e in Ungheria, dove sono stati prodotti più di 100 prototipi sotto la direzione del team leader, e coordinato dal Chief Scientist attraverso una perfetta interazione tra i gruppi di ricerca .

Il risultato finale è la scoperta della tecnologia EBM, in grado di sfruttare i campi elettromagnetici come combustibile per la generazione di energia ecologica al 100%.

Ogni verità attraversa tre fasi:
In primo luogo viene messa in ridicolo;
In secondo luogo, è violentemente opposta, e terzo, è accettato come OVVIO.
Arthur Schopenhauer (1788-1860)

DESCRIZIONE DELLA TECNOLOGIA

Come risultato di 22 anni di ricerca e sviluppo, Gamma Manager Kft ha scoperto e sfruttato una nuova fonte di energia, commercialmente valida e destinata a rivoluzionare il modo di produzione di energia.

Questa tecnologia, nota come EBM, è una macchina configurata in modo univoco rotante con acciai laminati e avvolgimenti in rame, simile per molti versi agli attuali motori commerciali di grandi dimensioni o generatori comunemente in uso oggi.

La somiglianza finisce, quando durante la rotazione si misura la combinazione tra calore e energia con il rilascio di maggiore energia fornita dalla manipolazione del campo elettromagnetico EBM.

Crediamo che questa fonte di energia (che ha una geometria inusuale comportandosi in modo diverso dagli attuali campi elettromagnetici utilizzati) in passato sconosciuta , possa produrre energia in eccesso che puo' essere venduta senza nessun impatto ambientale.

Il meccanismo attuale della fisica coinvolta in questa produzione di energia è l'informazione di proprietà.

La tecnologia EBM utilizza materiali standard e si basa su processi di produzione gia' esistenti.
Si tratta di non-nucleare, non tossico non emette alcun rumore o sostanze; è al 100% ecologico. Ancora più notevole è il fatto che il guadagno di energia è in funzione della massa di acciaio laminato utilizzato. Maggiore è la massa, maggiore è la produzione di energia vendibile!

Di recente, la ricerca e lo sviluppo si sono concentrati principalmente su questioni di commercializzazione, comprendendo la produzione e l'economia in essa connessa.

Sono gia' stati prodotti modelli EBM per la produzione di centrali elettriche (1,5, 5, 10 e 75 MW e multipli) fino a 150 MW.

L'efficienza delle unità è di gran lunga superiore ad altre forme di conversione energetica esistente e causera' un rivoluzionamento degli attuali impianti costosi, inquinanti e obsoleti. Ecco alcuni punti dei vantaggi della tecnologia EBM:

a) sostitutuzione delle centrali elettriche a carbone, petrolio e nucleari, divenute obsolete grazie all' EBM
b) de-salinizzazione del mare,
c) Produzione di azoto e ossigeno per terre sterili,
d) Produrre idrogeno a basso costo per la tecnologia delle celle a combustibile,
e) Produzione idroponica di cibo,
f) Trattamenti di depurazione,
g) riscaldamento e raffreddamento per vari scopi,

Di G. Mazzone & C

STAFF DELLA GAMMA MANAGER

Il professor Leslie I. Szabo,

Les Szabo ha oltre 30 anni di esperienza nel business di pubblica utilità e dell'energia, in Canada, Stati Uniti e in Europa.
Il professore ha gestito progetti di importo superiore di **30 miliardi di dollari** nei programma di sviluppo energetico. Ha scoperto e sviluppato la tecnologia EBM ed e' stato scelto come membro della "YOUNG Millionaires Club" a Edmonton.

Professionalmente collabora con le università tra cui quella meccanica Ungherese; R & D engineer Sopron, National Coal.Board, Londra, Inghilterra, Direttore di Economia, Public Utilities Board, Edmonton, Alberta, ingegnere progettista, Dominion Bridge, Edmonton Alberta, presidente, CEO Gamma Management and Engineering Co, Edmonton, Alberta, Canada;

Ferenc Wernsdorfer Ph.D., Chief Engineer, Manager KFT Gamma.

Oltre 20 anni di esperienza in ingegneria elettrica in Europa e Asia, capo del personale di ingegneria progettazione e costruzione di centrali elettriche;

Draga Balint, M. Sc., Director of Engineering, Direttore Kft GAMMA

Oltre 20 anni di esperienza nella progettazione di energia elettrica in Europa, con esperienza nel settore ingegneria energetica; per diversi anni, è riuscito staff multidisciplinare.

Michael Day, BA, B.Ed., presidente, G Technology Inc.Toronto Energia, Ont.

Le funzioni includono la formazione e lo sviluppo, la negoziazione di contratti ed accordi; oltre 10 anni di esperienza nel marketing;

Richard Gaughan, BA Sc., Direttore, per le tecnologie energetiche G Inc., Toronto, Ont.

Ingegnere meccanico con oltre 20 anni di esperienza, associato con società di ingegneria, project manager di installazione.

Wayne Warr, Chief Financial Officer, G Energy Technology di Toronto, Ont.

20 anni di consulenza nel settore bancario internazionale,per la strutturazione delle imprese e il finanziamento globale; 15 anni di consulenza per la produzione di energia rinnovabile; attualmente siede nei consigli vari, comprese le tecnologie Internet e la generazione di energia pulita.

Krisztina Sulyok, M.Sc., B. Sc, Economia, Gestione KFT Gamma.

Oltre 20 anni di esperienza in applicazioni informatiche, disegni e software nei settori dell'energia e delle industrie della salute; attualmente impegnata nella progettazione di software per applicazioni di ingegneria ed economia della EBM.

Imre Kovacs M. Sc, vice capo della produzione GAMMA Manager Kft;
Oltre 20 anni di esperienza nella progettazione e fabbricazione di macchine elettriche rotanti;

Sandor Sallói, responsabile dei Laboratori, GAMMA Manager Kft oltre 15 anni di esperienza nelle procedure di test di laboratorio;

László Nagy, direttore della costruzione, GAMMA Manager Kft.;

Michel Dubois, direttore della finanza internazionale e bancario, Bruxelles, Belgio, Manager Kft gamma;

Dr. Nicola Deiana, membro del consiglio dei dirigenti della Società, Economist, da diversi anni nella finanza internazionale;

L'Associated Engineering Group dei 20 senior R & D di ingegneria, progettazione, produzione e specialisti partner GAMMA, L'azienda elettrica più grande d'Ucraina.

Ci sono più di dieci docenti universitari e altri membri del personale scientifico e accademico sotto contratto con GAMMA che partecipano alle attività continue di R & S commerciale di EBM.

Video:

The EBM Midget Power Plant (Part I.)

http://www.youtube.com/watch?v=nigspbHT6Y8

The EBM Midget Power Plant (Part II.)

http://www.youtube.com/watch?v=FvuYEihqVKg


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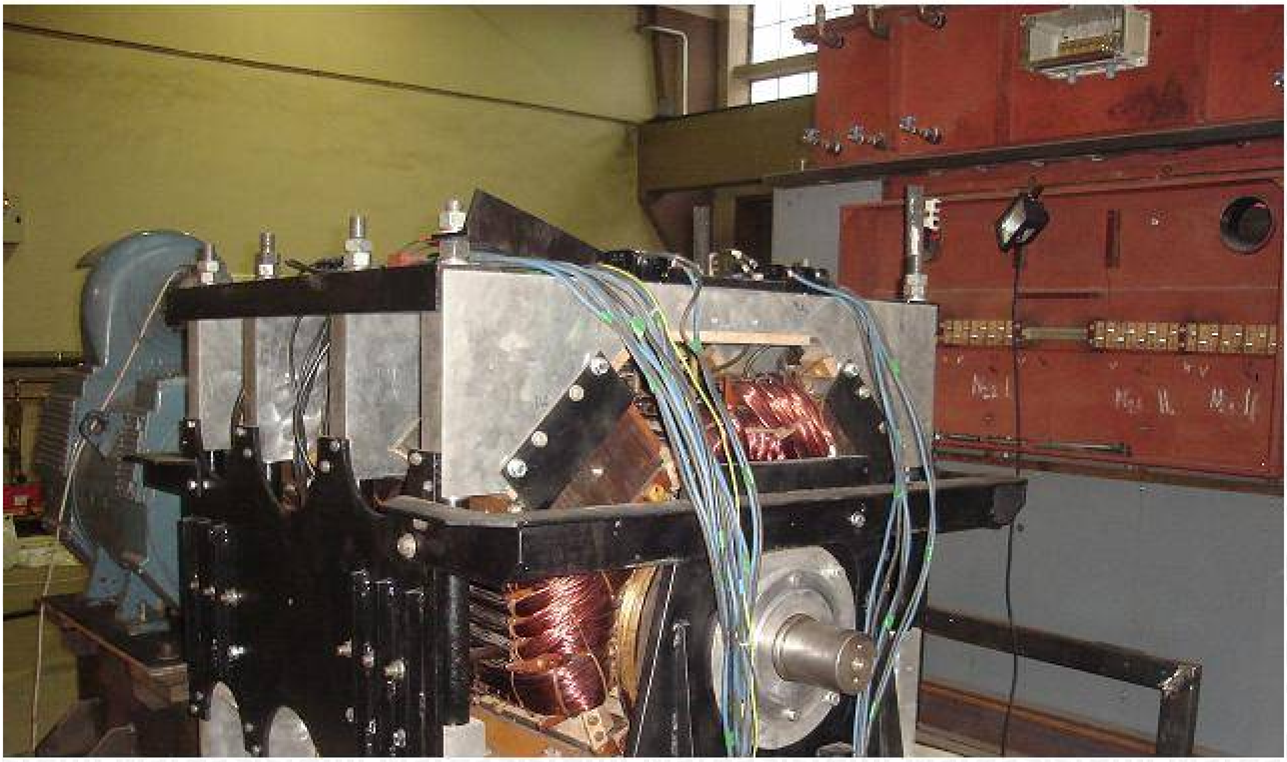

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INTRODUCTION OF GAMMA Manager Kft. Developer of EBM (Energy By Motion) FREE ENERGY

The EBM Power Plants are highly competitive, produce shaft power, electricity and heat with zero emission and noise.

Gamma's predecessor, Gamma Management Engineering Ltd. began its operation in 1963, in Edmonton, Alberta, Canada providing consulting, construction and expert witness services to electric power, gas, pipeline and telephone utilities in Canada, the United States, South America and Europe.

At peak periods Gamma Management's professional staff exceeded 400 and completed projects between 1963 and 1980 valued at several billion CAD.

Since 1986, Gamma Management's successor, Gamma Manager has worked in Texas (USA), Toronto, England, and Hungary, together with partner manufacturing companies, developing EBM technology. The present head office of Gamma Manager Kft is situated in Budapest, Hungary.

Gamma began involving and training the North American management through, a subsidiary of GAMMA Manager Kft. to commence marketing operations from Toronto, Ontario.

Gamma Manager Kft have successfully created the means to implement the distribution as well as a cohesive marketing and delivery system for the product. Over 400 Million USD has been spent in the research and development of this technology over the last 20 years.

The EBM Technology has been patented in a number of countries and patent applied for in 42 countries during the development stage.

All these patent applications have been allowed to lapse. The final and useful commercial versions of the EBM Technology will be protected in two (2) ways, namely:

Final and the useful version will be applied for in the same 42 countries, representing roughly 80% of the world's GDP, and By using the "COPY RIGHT" protection concept, which is for an indefinite time, without geographical or time limitations.

GAMMA Manager Kft. will have the initial EBM machines manufactured in Central Europe and/or the Ukraine as the manufacturing contracts have been negotiated and prices quoted. Discussions with Canadian manufacturers are underway to have subsequent units constructed in Ontario or Quebec. The initial product line will be between 3 MW and 10 MW in sellable electrical output. This size is specifically used as kick-start units.

Every truth passes through three stages before it is recognized, In the first it is ridiculed, in the second it is opposed, in the third it is regarded as self-evident

Arthur Schopenhauer (1788-1860)

Larger EBM Units of sizes ranging from 40 MW_e, 50 MW_e and 300 MW_e were ordered to be installed beginning late 2010. Gamma currently has a sizeable Group of Scientists and engineers responsible for the further commercial development, design and testing of EBM power plants, which will constitute the core of the initial EBM product line.

ENERGY BY MOTION RESEARCH PROGRAM SUMMARY

Energy by Motion (EBM) Technology is the result of a single project dealing with the manipulation of electromagnetic forces in order to create an energy source or tap unknown but theoretically postulated energy sources. The genesis of the technology pertains to the development of a system, the mechanism of which are based on a differential equation worked out by Professor L. I. Szabo (head of research of GAMMA Manager Kft. of Budapest Hungary) which demonstrates that it is possible, through certain electromagnetic manipulations, to create an energy producing system.

The hypothesis and differential equation upon which the research is based gives rise to the implication that the Laws of Thermodynamics must be modified to accommodate them.
While this is not the first time that the inviolability of the Laws of Thermodynamics has been called into question, it is the first time that a specific, manageable experiment has been developed that could prove or disprove the issue. The belief is that if there is any flaw in the laws, the nature of the modification is likely to shed light on the supposed “unified field theory” that has been the central theoretical issue in mainstream physics since the 1940’s and earlier.

In analyzing a particular differential equation (a mathematical formula describing physical properties in a given set of circumstances), Professor Szabo determined that the equation implied circumstances in which the law of conservation of energy did not apply. In essence, it suggested that, where an electromagnetic field has a certain mathematical “shape”, the energy output from the system could be as much as fifteen times the input or more!

As a result of finding this mathematical result, Professor Szabo set up in his lab a small electromagnetic rotor apparatus in early 1980’s and commenced testing of aspects of the differential equation. (See the recent confirmation of Professor Szabó’s findings: “How Do Space Energy Device Work? An explanation by Einstein-Cartan-Evans Theory” by Horst Eckardt, of Siemens, and the “Alpha Institute for Advanced Study (www.aias.com)” page 9, re:§ 12, GAMMA.)

Di G. Mazzone & C

At an early stage the apparatus was far too small to replicate the overall results sought – excess of energy output over energy input – but was sufficiently sophisticated that the equation could be confirmed in some of its key parts. From these advances in basic research, a full proof of GAMMA's hypothesis now has opened up a whole new technology for the generation of energy through electromagnetic manipulation that is capable because of its simplicity of being commercially exploited within a reasonable short time horizon.

In research into nuclear fusion and nuclear fission, it was found that small-scale experiments could give indications of scientific results, but could not produce hard data. Experience showed that hard data of measurable size could only be produced when the energy forces used in the experimentation were very powerful. So, for example, nuclear research uses very large-scale cyclotrons and synchrotrons to move atomic particles at extremely high speeds and to create high energy levels. The same principle applies in GAMMA's electromagnetic research.

Consequently, the small-scale testing by Professor Szabo indicated directions in which to go. The next step saw the building and testing of large-scale rotor assemblies that will produce powerful electromagnetic forces in many combinations. These rotor systems, computer controlled, can be made to carry out millions of tests of minutely different electromagnetic fields - tests which not only confirm or modify the differential equation, but also add to it by telling the researchers what variables and constants in the equation impact on the results, and how.

GAMMA used a number of research teams, primarily in Canada, in Texas, USA, the United Kingdom and in Hungary where over 100 prototypes were manufactured under the direction of the team leaders, and coordinated by the chief scientist through regular interaction between the research teams.

The end result is the discovery of EBM Technology – capable of harnessing electromagnetic fields as fuel for the generation of 100% environmentally friendly highly competitive energy – and its commercialization.

DESCRIPTION OF THE TECHNOLOGY

As a result of 22 years of high-level research and development, Gamma Manager Kft has discovered and harnessed a new source of energy - one that is commercially viable and destined to revolutionize the way of future energy production.

This technology, known as EBM, is a uniquely configured rotating machine using laminated steels and copper windings, similar in many ways to current large commercial motors or generators commonly in use today. The similarity ends, however, when one measures the combined electrical and heat output while being rotated through the EBM magnetic field. We believe this previously unknown source of energy in a magnetic field has an unusual geometry, and which behaves unlike any other known field, and allows existing EBM units to consistently produce far more than 100% excess, sellable energy! ***The actual mechanism of the physics involved in this energy production is proprietary information.***

EBM technology uses readily available materials and relies on existing manufacturing processes. It is non-nuclear, non-toxic, emits no noise or substances; it is 100% environmentally friendly. Even more remarkable is the fact that the energy gain is simply a function of the mass of inexpensive laminated steel in the unit. The larger the mass, the larger is the sellable extra output!

Of late, research and development has focused primarily on commercialization issues, including manufacturing and related economics. Full blueprints for the manufacture of 1.5, 5, 10 and 75 MW power plants and multiple thereof have now been completed, as well as schematics for several larger sizes up to 150 MW.

The efficiency of the units is far superior to other forms of energy conversion that it will make processes that were formerly too costly to now become commonplace:

- replace obsolete coal and oil fired plants and nuclear plants,
- de-salination of sea water,
- oxygen and nitrogen manufacture for infertile land,
- inexpensive hydrogen for fuel cell technology,
- hydroponic production of food,
- sewage treatment,
- heating and cooling for various purposes,

and this list is by no means exhaustive.

Video:

The EBM Midget Power Plant (Part I.)

http://www.youtube.com/watch?v=nigspbHT6Y8

The EBM Midget Power Plant (Part II.)

http://www.youtube.com/watch?v=FvuYEihqVKg

MANAGEMENT, BACKGROUND AND OUTSIDE CONSULTANTS

Professor Leslie I. Szabo,
Les Szabo has over 30 years experience in the public utility and energy business in Canada, USA and Europe. Les has managed projects in excess of $30 billion US in the utility, energy, pipeline and research and development fields. Invented, managed and developed the “ENERGY – BY – MOTION” [EBM] Technology. Les was selected as a member of the “YOUNG MILLIONAIRES CLUB” in Edmonton, Alberta before the age of 30years.
Associate professor, mechanical engineering, Sopron University, Hungary; R & D engineer, National Coal. Board, London, England; Director of Economics, Public Utilities Board, Edmonton, Alberta; Design engineer, Dominion Bridge, Edmonton Alberta; Chairman, CEO Gamma Management and Engineering Co, Edmonton, Alberta, Canada;

Ferenc Wernsdörfer Ph.D., Chief Engineer, Gamma Manager KFT.
Over 20 years experience in electrical engineering in Europe and Asia, Head of the design engineering staff and construction of power plants;

Balint Draga, M. Sc., Director of Engineering, GAMMA Manager Kft
Over 20 years experience in the electrical power engineering in Europe; experienced in power engineering field; for several years, managed multidisciplinary staff.

Michael Day,B.A,B.Ed.,President,G Energy Technology Inc.Toronto, Ont.
Duties include training and development, negotiating contracts and agreements; over 10 years experience in marketing;
Richard Gaughan, B.A. Sc., Director, G Energy Technology Inc., Toronto, Ont.
Practicing mechanical engineer with over 20 years experience; liaison with associated engineering companies; installation project manager.

Wayne Warr, Chief Financial Officer, G Energy Technology Toronto,Ont.
20 years consulting in international banking, corporate structuring and global financing; 15 years consulting in renewable energy power generation; currently sits on several boards including internet technology and power generation.

Krisztina Sulyok, M.Sc.,B.Sc, Economics, Gamma Manager KFT.
Over 20 years experience in computer applications and software designs in the energy and health industries; currently engaged in the software design for the EBM engineering applications and economics.

Imre Kovacs M.Sc; Deputy head of manufacturing GAMMA Manager Kft;
Over 20 years experience in the respective rotating electrical machinery design and manufacturing;

Sandor Sallói, Head of Laboratories, GAMMA Manager Kft over 15 years experience in LAB testing procedures;

László Nagy, Manager of construction, GAMMA Manager Kft.;

Michel Dubois, Manager of International Finance and Banking, Brussels, Belgium, GAMMA Manager Kft;

Nicola Deiana Dr., Member of the Board of the Executives of the Company, Economist, several years in international finance;

An **Associated Engineering Group** of 20 senior engineering R&D, design and manufacturing personnel and specialists from GAMMA’s affiliate partner from Ukraine’s largest electrical manufacturing company.

There are well over ten (10) university professors and other scientific and academic personnel under contract with GAMMA who participate in the continued commercial R&D work of EBM.

ANNEX

- THE OPERATION OF THE "ENERGY BY MOTION POWER PLANTS

- PATENT WO9318570 ASSYMETRICAL ELECTRO MECHANICAL DEVICE

GAMMA/EEL

The Operation of the "Energy By Motion" (EBM) Power Plants and Economic Comparisons of a Selected Few Generating Technologies in 2010

presented at the TESLA Symposium at the Vienna University Campus March 14, 2010

by Professor L. I. Szabo

1. The EBM Technology briefly highlighted

1.01 Slide 1 shows the cross section of an EBM Driving Unit, which is a motor or prime mover with its stator and rotor section together with the two coils on the stator, depicted as 226 and 446, respectively;

1.02 During operation of the prime mover/motor the two coils 226 and 446 create a similar type of magnetic field which we know and use in standard synchronous motors and generators for close to a century; This magnetic field drags or drives the rotor together with its shaft, onto which a standard A.C. or D.C generator or any other device is coupled which needs shaft power;

1.03 Once the rotor section of EBM is brought up to the predetermined working speed, the excited EBM Unit is started-up exactly the same way as an ordinary dynamo: A portion of the electric current from the attached generator is being fed back to excite the already rotating unit to continue its rotation;

1

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION International Bureau

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(72) Inventor; and
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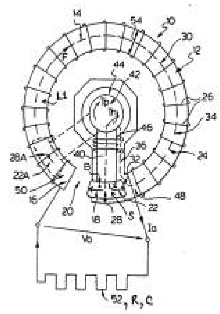


(57) Abstract

An asymmetrical, electro-mechanical device (10) comprises a geometrically-magnetically-asymmetrical stator (12) and a rotor (22) which move with respect to each other. There is a stator air gap (20) which makes the stator (12) asymmetrical. The magnetic flux passing from the rotor (22) to the stator (12) is interrupted when the rotor (22) passes by the stator air gap (20). The invention is able to achieve improvements over the prior art electro-mechanical devices, particularly in respect of efficiency.

The Operation of the "Energy By Motion" (EBM) Power Plants and Economic Comparisons of a Selected Few Generating Technologies in 2010

presented at the TESLA Symposium at the Vienna University Campus March 14, 2010

by Professor L. I. Szabo

1. The EBM Technology briefly highlighted

1.01 Slide 1 shows the cross section of an EBM Driving Unit, which is a motor or prime mover with its stator and rotor section together with the two coils on the stator, depicted as 226 and 446, respectively;

1.02 During operation of the prime mover/motor the two coils 226 and 446 create a similar type of magnetic field which we know and use in standard synchronous motors and generators for close to a century; This magnetic field drags or drives the rotor together with its shaft, onto which a standard A.C. or D.C generator or any other device is coupled which needs shaft power;

1.03 Once the rotor section of EBM is brought up to the predetermined working speed, the excited EBM Unit is started-up exactly the same way as an ordinary dynamo: A portion of the electric current from the attached generator is being fed back to excite the already rotating unit to continue its rotation;

1.04 Depending upon the designed working speed, the size of the excitation current, the amount of steel built into the unit, the air gaps provided and the number of poles [just to mention the most important parameters of the unit] an increasing or pre-determined load can be put on the attached generator or other device to be driven, up to the designed maximum torque, i.e. load;

1.05 The built-in control section, the GPS, the governors, the electronics and „Black box” components, and the safety controls take over to automatically drive the Driving EBM Section of the EBM Power Plant from this point onward; This is comparable to the operation of an aircraft on automatic pilot flying the aircraft under the watchful eyes of the captain and crew;

1.06 Slide 2: The first 3 pages of Section „A” explain the famous experiment conducted by Professor Joule to numerically test his 1st. or „chief” law of thermodynamics, which is being used in physics today, by universities and others all over the Globe;

1.07 Section „B” of Slide 2 shows the numerical results and graphs of actual controlled test of two(2) different sizes of EBM working prototypes, the 1,500 kg C 4/4 and the 8,500 kg E-720 Units, located in Budapest, duplicating and using Professor Joule’s test procedures; The graphs show the over unity ratio [OU], the sellable [extra] electric/shaft power [$\Delta P_{e(net/net)}$] and the input requirement into the EBM Driving Unit [$P_{input\ (net/net)}$], respectively;

1.08 Slide 3: Fig.1 shows the graph of an EBM Driving Unit with increasing sellable net/net output Power $\Delta P_{e(net/net)}$, with increasing rotational speed, RPM; ΔP_e net/net = ΔM [torque] x ω_{mech}; Thus, if ΔM [torque] = constant, as shown in Fig 1., then ΔP_e net/net is linearly increasing with RPM; This means, that if at the design stage the designer of the EBM Driving Unit has adequately taken into account the strength of materials, the need for appropriate higher speed bearings, etc. then the geometrically identically sized EBM Driving Unit can provide, for example, an output sellable ΔP_e net/net twice the otherwise available $\Delta P_{enet/net}$ of the physically same size EBM Unit! This is why it is important to optimize the sizes and number of EBM Units to provide for a given power needs!

2. Economic comparisons of electric power generations of different technologies of utility size operations for new plants equal or larger than 250 Megawatts, using Euro [€] in 2010.

2.01 Chart "A" in Slide 4 shows the summarized economic results for EBM, Solar, Wind, Advanced Nuclear, Innovative Coal and Innovative Natural Gas [Turbine] generations of electric power in 2010, listing the pertinent parameters of the respective plants under column "A";

2.02 (a) Slide 5 shows the manufacturing weights and total price in 2007 of the mechanical components, the coils, the steel housing and all mechanical other parts of a 75 MW_e EBM Driving Unit (prime mover) to be 5,650,629,884 HUF (Hungarian Forint) which translates into 20,928,260.- Euro using an exchange rate of 270 HUF/Euro; With 5 %

per year price increases to bring this up to 2010 price level, this works out to be 20,928,260 x $(1.05)^3$ = 24,227,076 Euro;

(b) Using 4 units of 75 MW_e, each, coupled by the shaft, to create a medium size power plant of 300 MW_e, this works out to: 4 x 24,227,076.- = 96,908,310.- Euro, or in rounded figure of 100 Million Euro;

(c) The additional estimated costs for a complete 300 MW_e EBM Power Plant, the following items are to be included:

(i) 300 MW_e synchronous generator;
(ii) Land, land clearing, road(s);
(iii) "Black Box" electronics ("Brain" of EBM Power Plant);
(iv) Water tower(s) (if needed);
(v) Substation;
(vi) Grid connection costs;
(vii) Power House;
(viii) Equipment to produce non-toxic driving flux-fuel for 40 years;
(ix) Insurance during transportation/erection;
(x) Duties, excise taxes, permits, pre-engineering study, VAT;
(xi) All other costs and contingencies;
(xii) Vendor and sub-traders' mark-ups;
(xiii) Total of items (i) to (xii) of 2.02 (c) estimated to be;
390 Million Euro;

(d) Thus, the estimated 2010 Total Installation Cost for the 300 MWe EBM Power Plant is 490 Million Euro;

2.03 Slide 6: depicts a 10 years cash-flow of the 300 MW_e EBM Power Plant, using:

(a) 100 % debt financing;

(b) 3 Euro cent per kWHe power rate;

(c) 95 % Base Load Factor/years (Capacity factor/year);

(d) Carbon trading revenue after 1st year of certification for not emitting green house gases;

2.04 Slide 7: Shows an other 10 years cash-flow of the same plant, as in Slide 6, except the power tariff rate is 8 Euro Cent/kWH_e, used by countries in Europe;

2.05 Returning to Chart "A" of Slide 4, column "B" shows selected pertinent data for EBM as follows:

Line 1: Turnkey cost: 1.63 Million Euro per MW_e, obtained for the 300 MW_e plant: 490,000,000.- Euro/300 MW_e = 1.63 Million Euro/MW_e

Line 2: Time required for example for the 300 MW_e plant from pre engineering to revenue producing: 2 years, obtained from the manufacturing company and from construction estimate by the contractor;

Line 3: Annual capacity factor is 95 %, as a base load plant;

Line 4: Cost per kWH_e, excluding subsidies: 2.79 Euro Cent/kWH_e obtained as follows:

(a) Capital cost (simplified levelized):

$$\frac{490{,}000{,}000.\text{- Euro x } 100\ ¢/\text{Euro}}{40 \text{ years life x } 8{,}760 \text{ hrs/yr x } 300 \text{ MWe x } 1000 \text{ kWe/MW x } 0.95} =$$

$$= 0.49 \text{ Euro Cent/kWH}_e$$

(b) Simplified annual cash expenses from Line (7) of Slide 6: total deductible expense (OMA+DEXP+DSC+RP+MF) = = € 53,023,800.-/year

(c) Rounded corporate income (CIT): € 4,292,136 ≈4,300,000 Euro/year

(d) Thus:

$$\frac{(53{,}023{,}800 + 4{,}300{,}000)\text{x}100\ ¢/\text{Euro}}{1\ \text{yr x } 8{,}760\ \text{hrs/yr x } 300\ \text{MW}_e\ \text{x } 1000\ \text{kW}_e\ \text{x } 0.95} =$$

$$= 2.296\ ¢/\text{kWH}_e \approx 2.3\ ¢/\text{kWH}_e$$

(e) Therefore: 0.49 + 2.30 = 2.79 Euro Cent/kW;

(f) Life cycle: 40 years: This is estimated to be the same as for large standard synchronous generators, based on the following:

(i) Historical experience by utility companies, with equipment similar in construction to the EBM Driving units, and

(ii) Using the so called "Truncated Normal Distribution Function" used in the life analysis of utility equipment for rate making purposes, where obsolescence plays an important role, in addition to "wear and tear"; (Kimball, Long Island Utility, Szabo, Alberta Public Utility Commission)

2.06 Column “C” of Slide 4 deals with solar power; Data in this column is derived from the information given in Slide 8 which is a copy out from the Hungarian language , March, 2010 issue of the “3rd Century, popular scientific and technical magazine, pages 94 and 95;

Reference is made to Chart “A”, Slide 4 as follows:

Line 1: The 2 GigaWatt (2000 MW_e) China solar power plant being built will cost 5 Billion USA Dollar and will take 8 years to build; These translate into the following simplified economic data:

(a) 5,000,000,000 USD / 1.35 USD/Euro = € 3,703,703,704.-

(b) 3,703,703,704/2000 MW = 1,851,852 Euro/MW_e

(c) 1,851,852/0.33 = 5,611,672 ≈5,62 Million Euro/MW_e (0.33 Load Factor is used per year to make solar comparable to the other technologies in Chart “A”)

Line 2: Reportedly 8 years to build by 2019;

Line 3: To make solar comparable to other generating technologies in Chart “A”, use 95 % annual capacity factor; (this does not improve on the intermittency factor of solar, only brings the name plate capacity comparable to the other technologies in Chart “A”!)

Line 4: (i) Cost per kWH_e (excluding subsidies) simplified levellized cost over 20 years estimated life:

5,620,000 Euro x 100 ¢ Euro/MW_e divided by

20 years x 8,760 hrs/yr x 1000 kW_e/MW_e= 3.20 ¢/kWH_e

(ii) Roughly estimated total annual expenses =

=25 % x 3.20 ¢/kW = 0.80 ¢/kWH_e

(iii) Thus, total cost = 3.20 + 0.80 = 4.00 Euro Cent/kWK_e

Line 5:   Estimated life cycle = 20 years;

2.07 Column “D” in Chart “A” in Slide 4, wind power:

Data used here for wind power is taken from “Volume 2, Wind Energy The Fact; by Paul Erik Morthorst, Senior Research Specialist at Risø National Laboratory, Denmark”, labelled Slide 9, and treated the same way for column “D” as data for solar in column “C”; Thus:

Line 1: Turn key cost: 1.333 Million Euro/MWe / 0.33 =
= 4 Milllion Euro/MWe
Here, too, 33 %/yr capacity factor is used to bring wind power name plate capacity comparable to the other generating technologies shown in Chart “A” (again, this does not improve the intermittency of wind power!);

Line 2: Is an estimate: 6 years;

Line 3: It is to make wind comparable wiht the rest in Chart “A”;

Line 4: It is taken from Slide 9;

Line 5: It is an estimate.

2.08 Columns “E”, “F” and “G” of Chart “A” in Slide 4 are taken from Slide 10, as follows:

(a) Nuclear Power’s Role in Generating Electricity, May, 2008, (USA) Congressional Budget Office (CBO), face sheet, plus pages 17, 18 and 32; (This report also deals with “Innovative Coal” and “Innovative Natural Gas”;)

(b) The economics of nuclear power: www.world-nuclear.org, January 2010, pages 1 and 4,

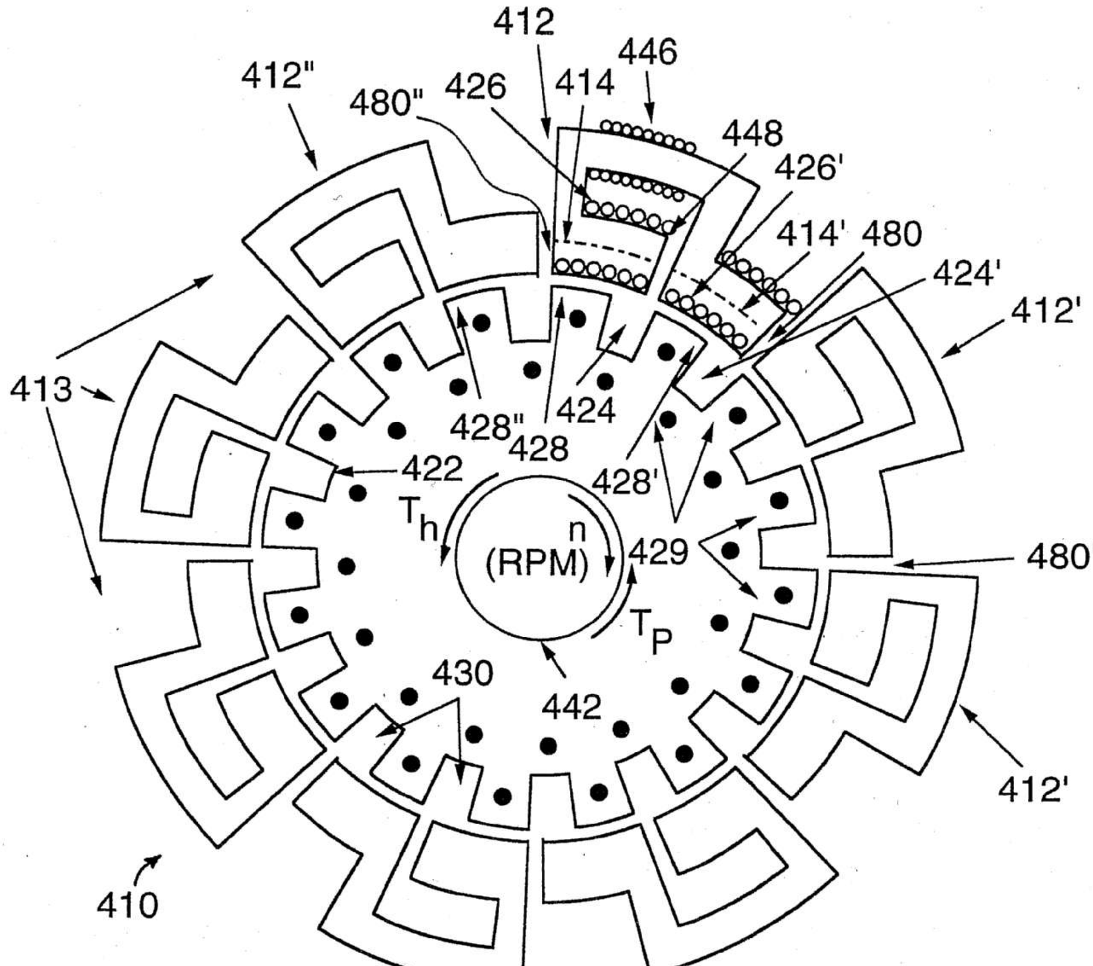
(c) From Wikipedia, 1 page

3. Summary

Chart "A" in Slide 4 is self explanatory and can be used in a decision making process to select from the various alternative electric generation alternatives.

LIS

Slide 1


412
446
412"
480"
426
414
448
426'
414'
480
424'
412'
413
428"
428
424
422
428'
Th
n
(RPM)
429
480'
TP
430
442
412'
410

A Measuring Usable Excess "Over Unity" Shaft Power of the EBM E-720 Unit in Budapest, using Joule's Method in Checking his 1st "Chief" Law of Thermodynamics; -and- the Increase of such Sellable Energy Due to Increased Iron Weight

By Professor L. I. Szabó

Introduction

To numerically test his 1st "Chief" Law of Thermodynamics, Joule used in his experiment the device shown in Figure 1. as follows:

1. In a well sealed container the water inside is stirred (agitated) by the rotating blades and the temperature rise due to the friction between the blades and the fluid is measured.

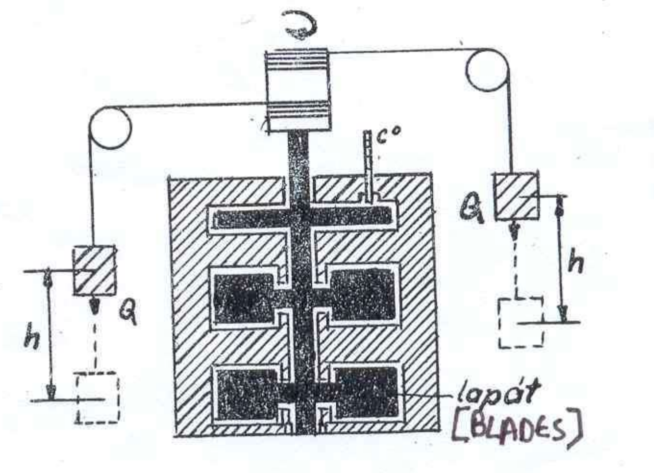


Figure 1.

2. The blades are rotated through the shaft by the two (2) Q [kg] weights as they descend over a distance of h [metre];

3. Since the container is well sealed ("adiabatic container"), no heating energy produced by the rising temperature could escape from the container and thus the increased "inner energy" increase of the water "A" can be simply measured as:

EQ (I) $A=m*c(t_2-t_1)$, where:

(a) m = mass of water,

(b) c = specific heat of water,

(c) t_2 = increased temperature of water, and

(d) t_1= temperature of water before the agitation of the fluid began;

The shaft energy "M" being provided ("transmitted") by the two (2) Q [kg] weights to increase the inner energy of the water can also be easily measured as:

EQ (II) M = 2*Q*h [metre kilogram], where

(a) Q [kg] = weight,

(b) h[metre] = distance,

(c) M [metre-kilogram] = torque = shaft energy;

Since no energy can escape from the container and only shaft energy "M" is being provided/transmitted to increase the inner energy "A" of the water, Joule concluded, based on his 1st (Chief) Law of Thermodynamics (being the Law of Energy Conservation) that the following must be true:

EQ (III) A = M, or

EQ (IV) $2Qh = m*c\ (t_2-t_1)$, or

EQ (V) M [metre-kg] = $m*c(t_2-t_1)$ [calorie]

Based on Joule's tests and measurements dividing by the right hand side of EQ (V) to obtain:

EQ (VI) 1 calorie = $\frac{2Qh}{m*c(t_2-t_1)}$

4. By accurate measurements, the following were obtained:

(a) 1 calorie = 0.427 mkg

(b) 1 kilocalorie = 427 mkg

(c) 1 calorie = 4,186 x 10^7 ERG = 4,186 Joule

(d) joule = 1 Wattsecundum = 0,239 calorie

(e) 1 mkg = 2,34 calorie

(f) 1 kilowatthour = 860 kilocalorie

(g) 1 HorsePower = 632,4 kilocalorie/sec

5. Our main observation relative to Joule's experiment is not the "conservation of Energy" as he stipulated, but that the "shaft energy" or torque can be measured by the generated heating energy, as will be seen in the next section, using actual measured test data for the EBM E-720 unit.

B The energy production by the EBM Technology

Technology

1. We will use the well known test method of the Law of Conservation of Energy used by Joule in establishing his 1st (Chief) Law of Thermodynamics to show the production of excess energy by the EBM Units, known as „free energy” or „the over the unity energy production”;

2. (a) We will use a simple example, and
   (b) The result of a repeated controlled test series of the E-720 EBM Unit;

3. The example:

   (a) It is well known that if we rotate the shaft of any rotating equipment, such as the E-720 EBM UNIT, then due to the friction of the bearings heat energy will be produced which can be measured in several ways as follows:
   (i) Let the rotating torque be: M [Newton Metre], and
   (ii) The mechanical rotating angular speed be: ω [1/sec];
   (iii) Thus, the rotational performance due to friction and ventilation, which will appear as heat performance in accordance with the law of conservation of energy, is:

   EQ.1: $P_{heat} = M \times \omega$ [watt];

   (b) If we do not have a torque metre to measure „M”, then we can still measure P_{heat} [watt], as in EQ.1, by using a heat exchanger, and by putting the device which is to be measured into a “perfect non-leaking” box; The heat exchanger will convert the warm air heated up by the friction of the bearings into, say, warm water; The heat energy content obtained is, as follows:

EQ.2: $$P_{heat} = 4{,}190 * \left(\frac{kg}{\sec}\right) * (t_2 - t_1)$$ [Watt]

where:

(i) 4,190 is the specific heat of the water;

(ii) $kg \sec$ is the $weight \sec$ of the water flowing out from the heat exchanger in every second, and

(iii) t_2-t_1, is the difference in temperature, measured in centigrade of the outflow/ inflow of water;

(c) Due to the law of energy conservation, we must have, using EQs. 1 and 2:

EQ.3: $P_{heat} = P^*_{heat}$

(d) EQ.3 means that the torque can be measured by the heat energy performance, using EQs. 1,2 and 3, as follows:

EQ.4: $M \times \omega = 4{,}190 \times (kg \sec)[t_2 - t_1]$, from which:

EQ.5: $$M = \frac{1}{\omega}\{4{,}190 \times (kg \sec)\}[t_2 - t_1]()$$

where torque is in Newton metre;

4. The proof of production of excess energy („over the unity”) by the EBM UNITS;

(a) We will use actual controlled test series of the E-720 EBM UNIT to duplicate the procedure given above under 3 of (B);

(b) In an actual test series with the EBM UNITS all the total inputted and outputted performances (energies) must be measured, and the difference must be recorded to arrive at the „over the unity” energy production, if any, of the unit under examination;

(c) Definitions:

EQ.6: Excess energy = ΔP = Total output - Total input [watt]

EQ.7: Over unity = $\frac{\Delta P}{Totalinput} = \frac{Totaloutput - Totalinput}{Totalinput} = \frac{Totaloutput}{Totalinput} - 1$

Expressed as a percent:

EQ.8: Over unity (%) = $\left(\frac{\Delta P}{Totalinput}\right) * 100 = \left(\frac{Totaloutput}{Totalinput} - 1\right) * 100$

Example:

If Total output/Total input = 1.3, then over unity (%)=30%;

(d) Components of the total output and total input during actual tests when we are measuring torque performance (shaft performance) of the EBM Units, using EQs.4 and 6 are:

(i) Since we are measuring the output heat energy in an enclosed box, we must take into account the produced heat by the UNIT which escapes through the walls of the box, similarly to the leaked out heat from a house during heating season; This will be designated as: $P_{leakage\ output}$ [watt], produced by the unit in the box;

(ii) The output heat performance which is measured as the out-flowing hot water from the heat exchanger, designated as: $P_{water\ output}$ [watt], the energy of which is produced by the unit in the box;

(iii) Thus the total output power = $P_{water\ output}+P_{leakage\ output}$ measured in watt;

Note: power=energy per unit of time.

(iv) The total input power components are:

A The driving motor input through the shaft:

$P_{motor\ input} = M \times \omega$ [watt]

B The inputted excitation power to maintain the magnetic field of the unit: $P_{excitation\ input}$ [watt]

C The inputted power by the ventilating fans inside the box to circulate the hot air in the box: $P_{vent.input}$ [watt]

D Thus total input power = $P_{motor\ input}+P_{excit.input}+P_{vent.inp.}$

(v) Therefore, using EQ.6, we have:

EQ.9: $\Delta P = (P_{water\ output} + P_{leakage\ output}) - (P_{motor\ input} + P_{exc.input} + P_{vent.input})$ [watt]

- or -

In Megawatts:

EQ.10: $\Delta P = \frac{EQ.9}{10^6}$ [MW]

EQ.11: The extra torque from EQ.9 $\Delta M = \frac{\Delta P}{\omega_{mechanical}}$ [Nm]___

(e) The simplest test which can be followed and checked by an observer to prove the over unity energy production by the EBM Units is when providing only magnetic excitation of the unit and leaving the armature coils (working coils) open; Thus, making the unit equivalent to a unit which has only permanent magnets, which maintain the magnetic field of the unit; It is known that such a unit cannot and should not be able to produce extra, over the unity torque energy, or carry any load whatsoever!

EQ.12: $\Delta M = \frac{7125}{n/9.55} = 90.725$ Newton Metre (at n=750 rpm)

The over unity shaft power production by the August 15/06 test is as follows:

(i) Over unity % = $\frac{\Delta P * 100}{\Sigma P_{input}} = \frac{7,390}{24,900} * 100 = 29.68$

And, if we do not use ventilation to speed up the test procedure, and use permanent magnets for excitation, then we have:

(ii) Over unity % = $\frac{7,390}{19,100} * 100 = 38.7$, computed as follows:

If: $P_{vent}+P_{excit}$ = 4,900+900 = 5,800 Watt

$P_{water\ output}$ + $P_{leakage}$ = 29,490 + 2,800 = 32,290 Watt

Total input = P_{motor} = 19,100 Watt,

Thus: ΔP = (32,290-5,800)-19,100 = 7,390 Watt, and

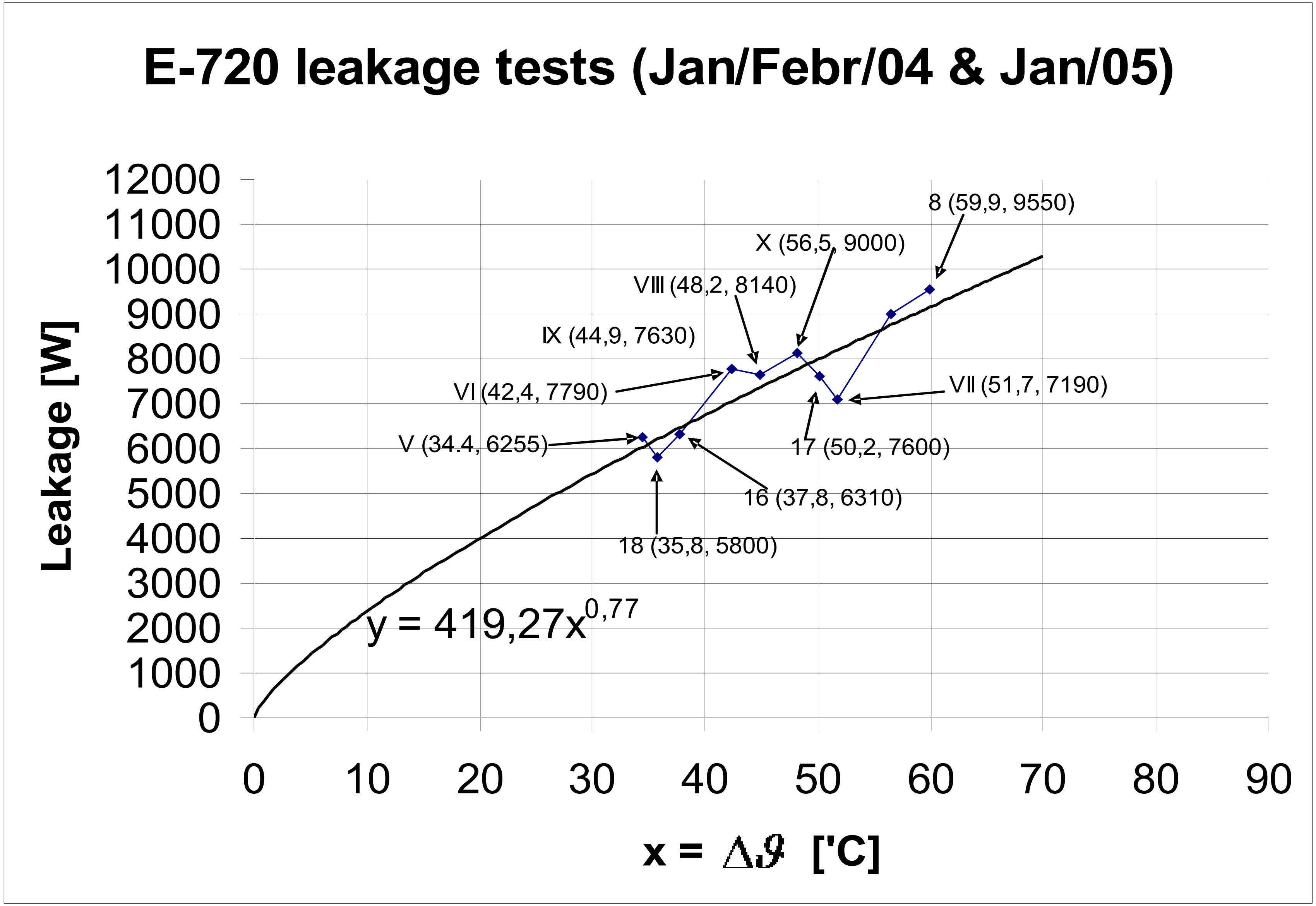
over unity % = 7,390/19,100 * 100 % = 38.7 %

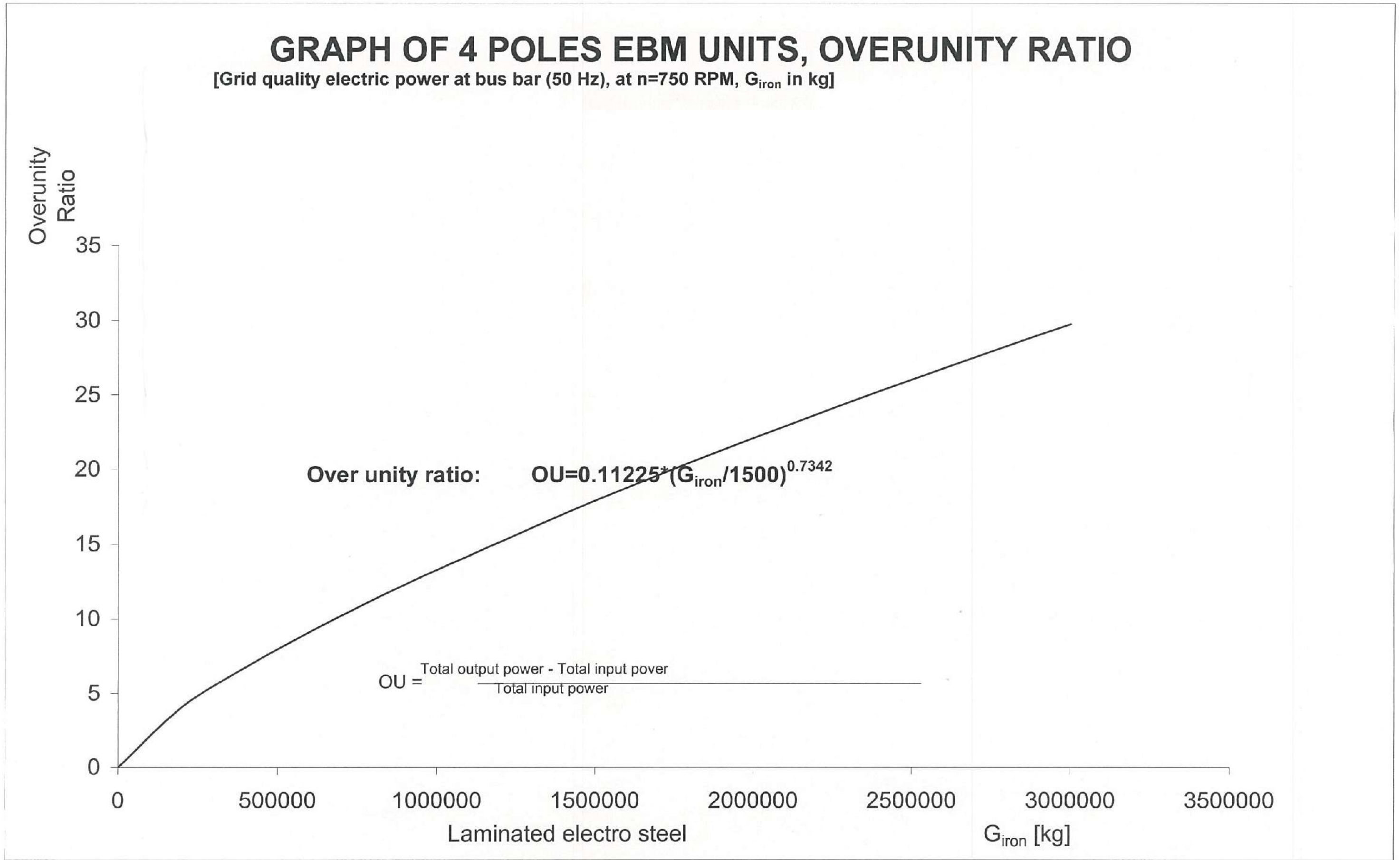
(g) Based on actual test results, the ΔP, using the EBM Technology, is linearly increasing with the RPM; (This is shown in the attached 1 page) Thus at say, n=3600 RPM, the above ΔP would be:

<u>EQ.13:</u> $\Delta P = \frac{3600}{750} * 7,125 = 4.8 * 7,125 = 34,200$ [watt]

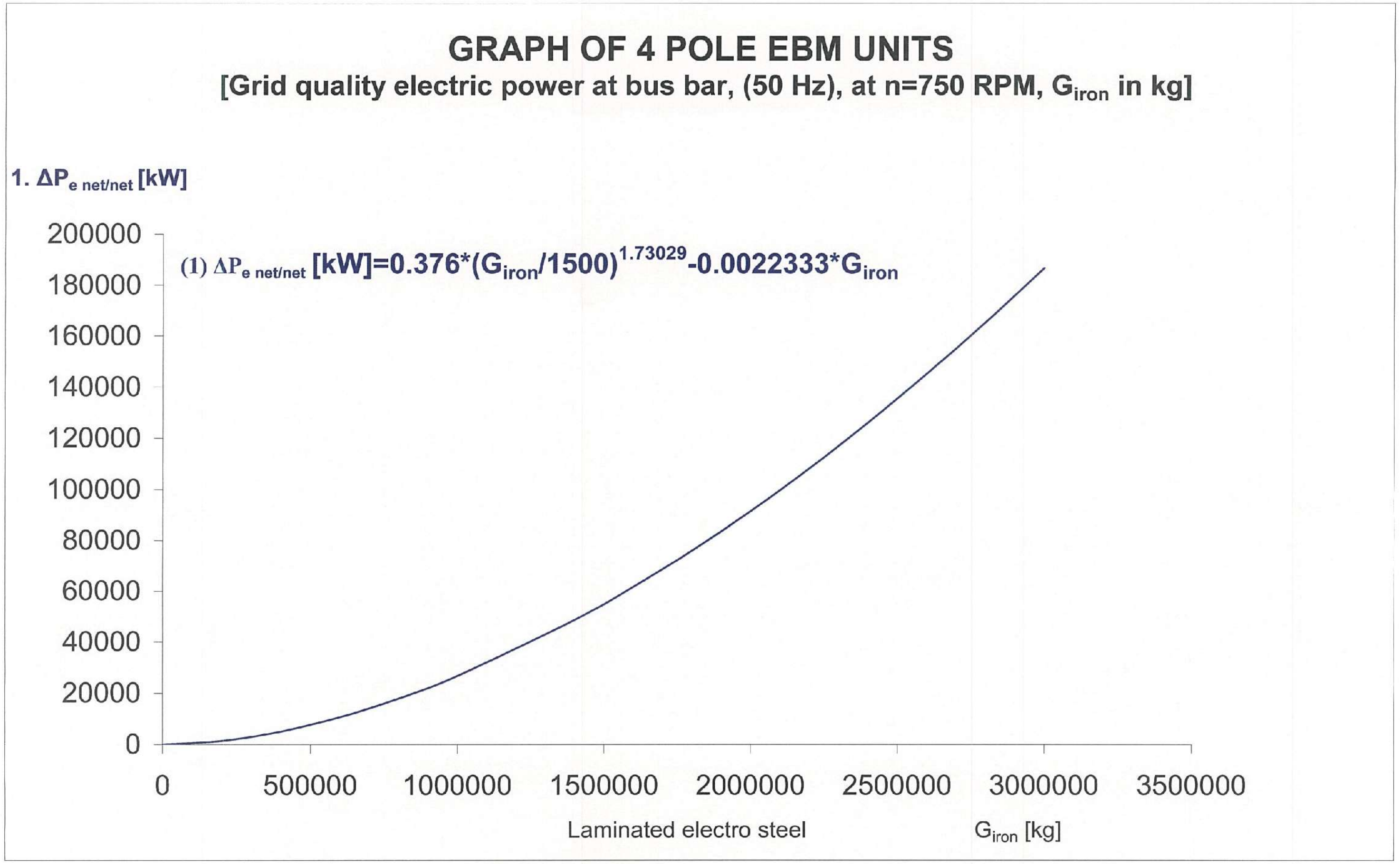
(h) It should be noted, that due to safety reasons (as a rule), we do not exceed 750 RPM in the lab, with our operating prototype E-720 UNIT;

5. Under Tab 3 is the scalability of the EBM prototype Units to larger Units, certified by utility executives and university professors in 2006

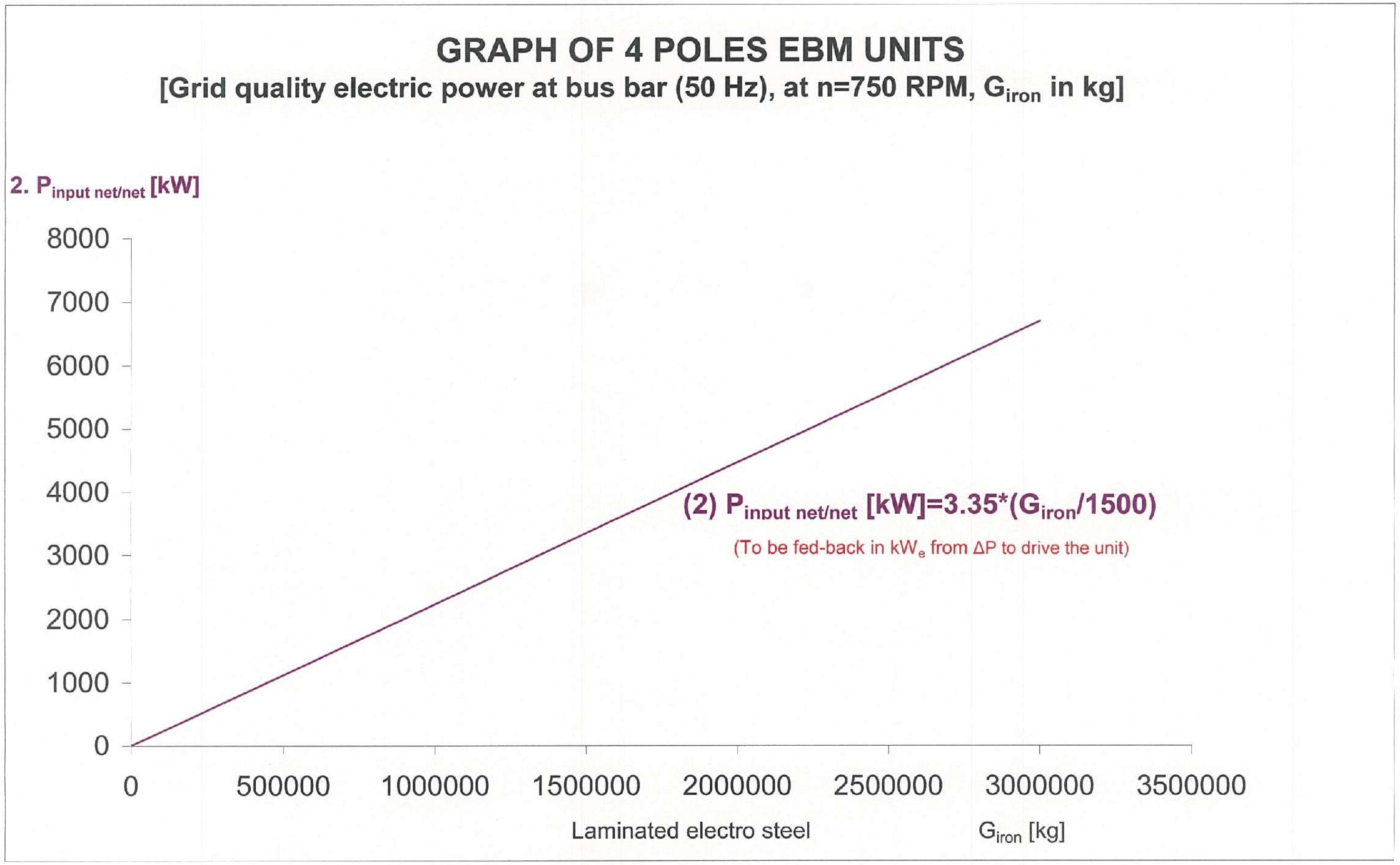

E-720 leakage tests (Jan/Febr/04 & Jan/05)
Leakage [W]
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0
10
20
30
40
50
60
70
80
90
x = Δϑ ['C]
y = 419,27x0,77
8 (59,9, 9550)
X (56,5, 9000)
VIII (48,2, 8140)
IX (44,9, 7630)
VI (42,4, 7790)
VII (51,7, 7190)
V (34.4, 6255)
17 (50,2, 7600)
16 (37,8, 6310)
18 (35,8, 5800)



GRAPH OF 4 POLES EBM UNITS, OVERUNITY RATIO
[Grid quality electric power at bus bar (50 Hz), at n=750 RPM, G_iron in kg]
Overunity Ratio
35
30
25
20
15
10
5
0
Over unity ratio: OU=0.11225*(G_iron/1500)^0.7342
OU = Total output power - Total input pover / Total input power
0
500000
1000000
1500000
2000000
2500000
3000000
3500000
Laminated electro steel
G_iron [kg]



GRAPH OF 4 POLE EBM UNITS
[Grid quality electric power at bus bar, (50 Hz), at n=750 RPM, G_{iron} in kg]
1. $\Delta P_{e\ net/net}$ [kW]
(1) $\Delta P_{e\ net/net}$ [kW]=0.376*(G_{iron}/1500)$^{1.73029}$-0.0022333*G_{iron}
200000
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
0
500000
1000000
1500000
2000000
2500000
3000000
3500000
Laminated electro steel
G_{iron} [kg]


GRAPH OF 4 POLES EBM UNITS
[Grid quality electric power at bus bar (50 Hz), at n=750 RPM, G_{iron} in kg]
2. $P_{input\ net/net}$ [kW]
8000
7000
6000
5000
4000
3000
2000
1000
0
0
500000
1000000
1500000
2000000
2500000
3000000
3500000
(2) $P_{input\ net/net}$ [kW]=3.35*(G_{iron}/1500)
(To be fed-back in kW_e from ΔP to drive the unit)
Laminated electro steel
G_{iron} [kg]

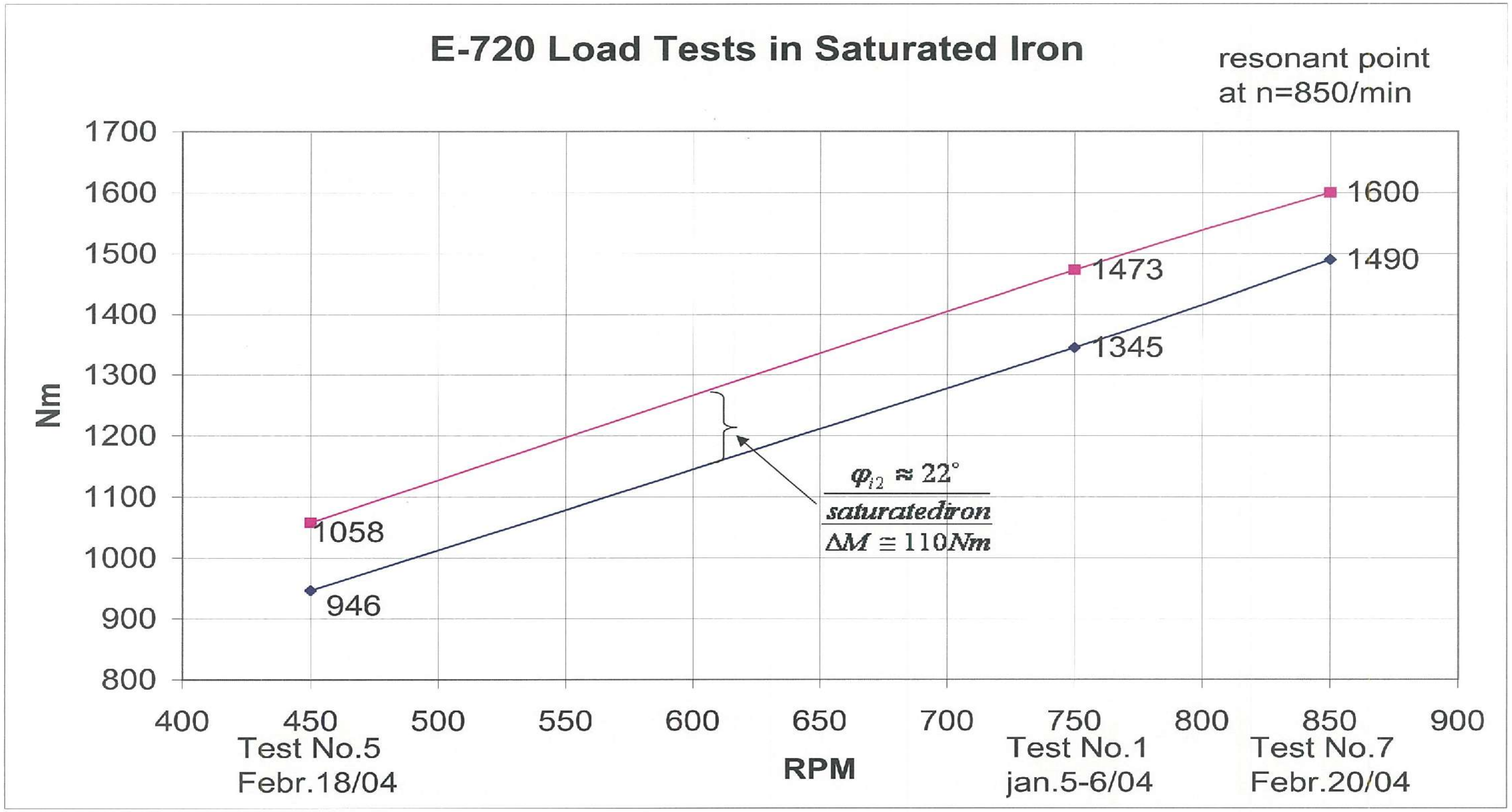

E-720 Load Tests in Saturated Iron
resonant point
at n=850/min
Nm
1700
1600
1500
1400
1300
1200
1100
1000
900
800
1600
1490
1473
1345
1058
946
$\varphi_{i2} \approx 22^\circ$
saturated iron
$\Delta M \cong 110 Nm$
400
450
500
550
600
650
700
750
800
850
900
RPM
Test No.5
Febr.18/04
Test No.1
jan.5-6/04
Test No.7
Febr.20/04

Chart „A"

Economic Comparisons of Electric Power Generations of Different Technologies(1) of Utility Size Operations for New Plants ≥ 250 Megawatts Using Euro [€] in 2010

No	Pertinent parameter of Power Plant	EBM	Solar	Wind	Advanced Nuclear	Innovative Coal	Innovative Natural Gas
	A	B	C	D	E	F	G
1	Turn key cost: Euro per MW_e	1.63 Million	5.62 Million	4 Million	6 Million	4 Million	1 Million
2	Time required from pre-eng. to revenue producing	2 YR	8 YR	6 YR	8 YR	4 YR	3 YR
3	Annual capacity factor	95 %	95 %	95 %	95 %	95 %	95 %
4	Cost per KwHe, Excl, Subsidies	2.79 ¢	4.00 ¢	6.00 ¢	5.20 ¢	5.93 ¢	7.07 ¢
5	Life cycle [YEAR] estimated	40	20	15	40	30	15

(1) Important notes regarding „turn key cost" of solar and wind:
- (a) Needed sizeable investment not included to provide predictable MW_e power per day;
- (b) Turn key cost of „name plate capacity" is multiplied by 3 to make solar and wind comparable with the other generating technologies in Chart „A" due to their annual capacity factor of 33 %;

G-300 C4/4 Weights and Manufacturing Costs in HUF

(Costs do not include value added tax or "vats")

Type: G-300 C4/4

	Material:		Cast Iron Göv 500	Electro Steel	KOR steel	Carbon Steel	Bronze PbBz ő5	Copper	Insulation Material	Cast Steel	TOTAL
	Parts:		A	B	C	D	E	F	G	H	
1	Rotor	a:		470.400	34.954	158.600					663.954
P1,		b:		30.131.200	124.855.688	90.402.000			11.000.000		256.388.888
P2		c:		141.120.000	48.166.612	32.513.000					221.799.612
2	Stator	a:		967.232				108.434	10.956		1.086.622
P5		b:		72.160.000				240.461.344	5.478.000		318.099.344
		c:		290.169.600				325.302.000	11.098.428		626.570.028
3	Coils	a:		556.800	177.141	7.133		36.000			777.074
P7		b:		31.900.000	632.747.652	4.065.810		79.832.971			748.546.433
		c:		167.040.000	244.100.298	1.462.265		108.000.000			520.602.563
4	Housing	a:			279.000	120.000				97.600	496.600
P6		b:			996.588.000	68.400.000				348.627.200	1.413.615.200
		c:			384.462.000	24.600.000				536.800.000	945.862.000
5	Bearings	a:	145.000			13.600	2.200			18.000	178.800
P4		b:	234.175.000			7.752.000	2.200.000			64.296.000	308.423.000
		c:	101.500.000			2.788.000	12.100.000			99.000.000	215.388.000
6	Heat exch.	a:			4.740	8.000		15.576		1.440	29.756
P3		b:			16.931.280	4.560.000		9.034.080	4.400.000	5.143.680	40.069.040
		c:			6.531.720	1.640.000		19.174.056		7.920.000	35.265.776
	Total	a:	145.000	1.994.432	495.835	307.333	2.200	160.010	10.956	117.040	3.232.806
		b:	234.175.000	134.191.200	1.771.122.620	175.179.810	2.200.000	329.328.395	20.878.000	418.066.880	3.085.141.905
		c:	101.500.000	598.329.600	683.260.630	63.003.265	12.100.000	452.476.056	11.098.428	643.720.000	2.565.487.979

Notes: a:Material gross weight [kg]
b: Labour costs (HUF)
c:Costs of material (HUF)

Total costs: (b+c) **5.650.629.884**

Checked: Date: 07.16./ 07.

100 % DEBT FINANCING CASH FLOW PROJECTIONS FOR A 300 MEGAWATT EBM UNIT FOR CHINA No. 1 PROJECT, 10 YEARS OF REVENUE (Figures in Euro)

Total Installed Cost, except land (TIC)	Electric Capacity (kw)	Load Factor for elect. (95%)	Elec. Selling Price (in 1-5 yrs 0.03 €/kwh, in 6-10 yrs 0,04 €/kWh)	Inflating rate	Green point/reve
€ 490.000.000	300.000	0,95	0,03	0,03	0,03

			1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year
1	Operating Revenue	OPRV										
	a) electricity (300 MW @ 0.03 €/kwh)		€ 74.898.000	€ 74.898.000	€ 74.898.000	€ 74.898.000	€ 74.898.000	€ 99.864.000	€ 99.864.000	€ 99.864.000	€ 99.864.000	€ 99.864.000
	b) heating/cooling energies (45 MW 0.01 €/kwh LF:50%)		€ 1.971.000	€ 1.971.000	€ 1.971.000	€ 1.971.000	€ 1.971.000	€ 2.562.300	€ 2.562.300	€ 2.562.300	€ 2.562.300	€ 2.562.300
	c) Green Point Revenue (300 MW @ 0.03 €/kWh)			€ 74.898.000	€ 74.898.000	€ 74.898.000	€ 74.898.000	€ 74.898.000	€ 74.898.000	€ 74.898.000	€ 74.898.000	€ 74.898.000
	d) Total OPRV		€ 76.869.000	€ 151.767.000	€ 151.767.000	€ 151.767.000	€ 151.767.000	€ 177.324.300	€ 177.324.300	€ 177.324.300	€ 177.324.300	€ 177.324.300
2	Operation, Maintenance & Admin	OMA										
	a) 6 operators X 26,000 €/person		€ 156.000	€ 160.680	€ 165.500	€ 170.465	€ 175.579	€ 180.847	€ 186.272	€ 191.860	€ 197.616	€ 203.545
	b) 4 administrators X 15,000 €/person		€ 60.000	€ 61.800	€ 63.654	€ 65.564	€ 67.531	€ 69.556	€ 71.643	€ 73.792	€ 76.006	€ 78.286
	c) 1 manager X 40,000 €/person		€ 40.000	€ 41.200	€ 42.436	€ 43.709	€ 45.020	€ 46.371	€ 47.762	€ 49.195	€ 50.671	€ 52.191
	d) Repairs and maintenance		€ 200.000	€ 206.000	€ 212.180	€ 218.545	€ 225.102	€ 231.855	€ 238.810	€ 245.975	€ 253.354	€ 260.955
	e) Real taxes and insurance		€ 144.000	€ 148.320	€ 152.770	€ 157.353	€ 162.073	€ 166.935	€ 171.944	€ 177.102	€ 182.415	€ 187.887
	f) Office expense other than labour		€ 200.000	€ 206.000	€ 212.180	€ 218.545	€ 225.102	€ 231.855	€ 238.810	€ 245.975	€ 253.354	€ 260.955
	g) Contingencies		€ 100.000	€ 103.000	€ 106.090	€ 109.273	€ 112.551	€ 115.927	€ 119.405	€ 122.987	€ 126.677	€ 130.477
	h) Total OMA		€ 900.000	€ 927.000	€ 954.810	€ 983.454	€ 1.012.958	€ 1.043.347	€ 1.074.647	€ 1.106.886	€ 1.140.093	€ 1.174.296
3	Depreciation											
	a) over 20 years	DEXP	€ 24.500.000	€ 24.500.000	€ 24.500.000	€ 24.500.000	€ 24.500.000	€ 24.500.000	€ 24.500.000	€ 24.500.000	€ 24.500.000	€ 24.500.000
4	Debt Service Charge	DSC										
	a) 2.5% of 490,000,000 €		€ 12.250.000	€ 12.250.000	€ 12.250.000	€ 12.250.000	€ 12.250.000	€ 12.250.000	€ 12.250.000	€ 12.250.000	€ 12.250.000	€ 12.250.000
5	Royalty Paymenrt (10 % X OPRV)	RP	€ 7.686.900	€ 15.176.700	€ 15.176.700	€ 15.176.700	€ 15.176.700	€ 17.732.430	€ 17.732.430	€ 17.732.430	€ 17.732.430	€ 17.732.430
6	Management fee											
	10 % X OPRV	MF	€ 7.686.900	€ 15.176.700	€ 15.176.700	€ 15.176.700	€ 15.176.700	€ 17.732.430	€ 17.732.430	€ 17.732.430	€ 17.732.430	€ 17.732.430
7	Total Deductible Expenses (OMA+DEXP+DSC+RP+MF)	OPXP	€ 53.023.800	€ 68.030.400	€ 68.058.210	€ 68.086.854	€ 68.116.358	€ 73.258.207	€ 73.289.507	€ 73.321.746	€ 73.354.953	€ 73.389.156
8	Pre-tax Profit (OPRV - OPXP)	PTP	€ 23.845.200	€ 83.736.600	€ 83.708.790	€ 83.680.146	€ 83.650.642	€ 104.066.093	€ 104.034.793	€ 104.002.554	€ 103.969.347	€ 103.935.144
9	Corporate Income Tax (@ 18% x PTP)	CIT	€ 4.292.136	€ 15.072.588	€ 15.067.582	€ 15.062.426	€ 15.057.116	€ 18.731.897	€ 18.726.263	€ 18.720.460	€ 18.714.482	€ 18.708.326
10	**Cash in Hand After Tax (PTP-CIT+RP+MF)**	**CAT**	**€ 34.926.864**	**€ 99.017.412**	**€ 98.994.608**	**€ 98.971.119**	**€ 98.946.926**	**€ 120.799.057**	**€ 120.773.390**	**€ 120.746.954**	**€ 120.719.724**	**€ 120.691.678**

100 % DEBT FINANCING CASH FLOW PROJECTIONS FOR A 300 MEGAWATT EBM UNIT, 10 YEARS OF REVENUE

Electromagnetic fuel is included for 40 years (all figures in EURO)

Total Installed Cost, except land (TIC)	Electric Capacity (kw)	Load Factor for elect. (95%)	Elec. Selling Price (in 1-5 yrs 0.08 €/kwh, in 6-10 yrs 0,09 €/kWh)	Inflating rate	Green point/reve
€ 490.000.000	300.000	0,95	0,08	0,03	0,08

			1st Year	2nd Year	3rd Year	4th Year	5th Year	6th Year	7th Year	8th Year	9th Year	10th Year
1	Operating Revenue	OPRV										
	a) electricity (300 MW @ 0.08 €/kwh)		€ 199.728.000	€ 199.728.000	€ 199.728.000	€ 199.728.000	€ 199.728.000	€ 224.694.000	€ 224.694.000	€ 224.694.000	€ 224.694.000	€ 224.694.000
	b) heating/cooling energies (45 MW 0.01 €/kwh LF:50%)		€ 1.971.000	€ 1.971.000	€ 1.971.000	€ 1.971.000	€ 1.971.000	€ 2.562.300	€ 2.562.300	€ 2.562.300	€ 2.562.300	€ 2.562.300
	c) Green Point Revenue (300 MW @ 0.08 €/kWh)			€ 199.728.000	€ 199.728.000	€ 199.728.000	€ 199.728.000	€ 199.728.000	€ 199.728.000	€ 199.728.000	€ 199.728.000	€ 199.728.000
	d) Total OPRV		€ 201.699.000	€ 401.427.000	€ 401.427.000	€ 401.427.000	€ 401.427.000	€ 426.984.300	€ 426.984.300	€ 426.984.300	€ 426.984.300	€ 426.984.300
2	Operation, Maintenance & Admin	OMA										
	a) 6 operators X 26,000 €/person		€ 156.000	€ 160.680	€ 165.500	€ 170.465	€ 175.579	€ 180.847	€ 186.272	€ 191.860	€ 197.616	€ 203.545
	b) 4 administrators X 15,000 €/person		€ 60.000	€ 61.800	€ 63.654	€ 65.564	€ 67.531	€ 69.556	€ 71.643	€ 73.792	€ 76.006	€ 78.286
	c) 1 manager X 40,000 €/person		€ 40.000	€ 41.200	€ 42.436	€ 43.709	€ 45.020	€ 46.371	€ 47.762	€ 49.195	€ 50.671	€ 52.191
	d) Repairs and maintenance		€ 200.000	€ 206.000	€ 212.180	€ 218.545	€ 225.102	€ 231.855	€ 238.810	€ 245.975	€ 253.354	€ 260.955
	e) Real taxes and insurance		€ 144.000	€ 148.320	€ 152.770	€ 157.353	€ 162.073	€ 166.935	€ 171.944	€ 177.102	€ 182.415	€ 187.887
	f) Office expense other than labour		€ 200.000	€ 206.000	€ 212.180	€ 218.545	€ 225.102	€ 231.855	€ 238.810	€ 245.975	€ 253.354	€ 260.955
	g) Contingencies		€ 100.000	€ 103.000	€ 106.090	€ 109.273	€ 112.551	€ 115.927	€ 119.405	€ 122.987	€ 126.677	€ 130.477
	h) Total OMA		€ 900.000	€ 927.000	€ 954.810	€ 983.454	€ 1.012.958	€ 1.043.347	€ 1.074.647	€ 1.106.886	€ 1.140.093	€ 1.174.296
3	Depreciation											
	a) over 20 years	DEXP	€ 24.500.000	€ 24.500.000	€ 24.500.000	€ 24.500.000	€ 24.500.000	€ 24.500.000	€ 24.500.000	€ 24.500.000	€ 24.500.000	€ 24.500.000
4	Debt Service Charge	DSC										
	a) 2.5% of 490,000,000 €		€ 12.250.000	€ 12.250.000	€ 12.250.000	€ 12.250.000	€ 12.250.000	€ 12.250.000	€ 12.250.000	€ 12.250.000	€ 12.250.000	€ 12.250.000
5	Royalty Paymenrt (10 % X OPRV)	RP	€ 20.169.900	€ 40.142.700	€ 40.142.700	€ 40.142.700	€ 40.142.700	€ 42.698.430	€ 42.698.430	€ 42.698.430	€ 42.698.430	€ 42.698.430
6	Management fee											
	10 % X OPRV	MF	€ 20.169.900	€ 40.142.700	€ 40.142.700	€ 40.142.700	€ 40.142.700	€ 42.698.430	€ 42.698.430	€ 42.698.430	€ 42.698.430	€ 42.698.430
7	Total Deductible Expenses (OMA+DEXP+DSC+RP+MF)	OPXP	€ 77.989.800	€ 117.962.400	€ 117.990.210	€ 118.018.854	€ 118.048.358	€ 123.190.207	€ 123.221.507	€ 123.253.746	€ 123.286.953	€ 123.321.156
8	Pre-tax Profit (OPRV - OPXP)	PTP	€ 123.709.200	€ 283.464.600	€ 283.436.790	€ 283.408.146	€ 283.378.642	€ 303.794.093	€ 303.762.793	€ 303.730.554	€ 303.697.347	€ 303.663.144
9	Corporate Income Tax (@ 18% x PTP)	CIT	€ 22.267.656	€ 51.023.628	€ 51.018.622	€ 51.013.466	€ 51.008.156	€ 54.682.937	€ 54.677.303	€ 54.671.500	€ 54.665.522	€ 54.659.366
10	**Cash in Hand After Tax (PTP-CIT+RP+MF)**	**CAT**	**€ 141.781.344**	**€ 312.726.372**	**€ 312.703.568**	**€ 312.680.079**	**€ 312.655.886**	**€ 334.508.017**	**€ 334.482.350**	**€ 334.455.914**	**€ 334.428.684**	**€ 334.400.638**

11 Notes: 1) Electrical selling price is 0,08 €/kWh (appx. 0.12 USD/kWH), Heat energy is 0,01 €/kWh in 1-5 years, from 6th year the prices are : electricity=0,09 €/kWh, Heat energy = 0,013 €/kWh

2) Power house cost of 5 Million € TIC is included.

3) The green point revenue [1(c)] is available due to the Kyoto Protocol for not emitting green house gases (CO2, CO, NOx); from 2nd year, will be sold as per Chicago Exchange by broker firm

4) Life expectancy of the Power Plant is 40 years.

5) Land is not included for the Power Plant, will be granted by government free.

6) Borrowed funds of 490 Million € is repaidat the end of the 20th year. (from the sinking fund established in year 1), using 3(a) DEXP;

7) Royalty payments (RP) and management fee (MF) are rebated to owners of the power plant.

Slide 8

Óriás energiapark épül a határainkon túl

» Európa legnagyobb naperőműve a volt szovjet katonai területen, Lieberose-ban épült

FOTÓ: SOLARPARK-LIEBEROSE.DE

Kétszáz futballpálya már jelentős nagyságú helyet foglal el, és pontosan ilyen nagy területen fekszik a Lieberose naperőmű, amelyet a németek Brandenburgban, Cottbus közelében építettek fel. Abban az időszakban, amikor még létezett a Német Demokratikus Köztársaság, az NDK, itt volt a megszálló szovjet hadsereg katonai kiképzési területe. Most e helyet jobban kihasználják.

A JÖVŐ LEGNAGYOBB NAPERŐMŰVE KÍNÁBAN LESZ

Ha minden a terv szerint halad, a 2019-es év mérföldkő lesz a napenergia történetében. Addigra Kínában készen kell állnia a **gigantikus fotoelektromos erőműnek**, amelynek teljesítménye elérné a 2 gigawattot. Az erőmű **kínai sivatagi területeken épül** majd, és **beindulása után hárommillió házat látna el**. A félvezető napelem, amely elősegíti ennek a csodálatos célkitűzésnek az elérését, vékonyréteg CdTe **(kadmium tellurid) technológián alapszik.** Az építkezésről Kína a First Solar amerikai társasággal írt alá szerződést. A csodálatos építkezés teljes költsége jelenlegi becslések szerint 5 milliárd dollár. «

FOTÓ: WWW.GERMAN-RENEWABLE-ENERGY.COM

A német napenergiatelep méretével a maga kategóriájában a világon a második helyet foglalja el. Ennél nagyobb a kaliforniai Mojave-sivatagban épült naperőműrendszer, a Mojava Solar Park (Solar Energy Generating Systems), de ez hamarosan tovább fog növekedni, mert már 40 négyzetméter napkollektor képes egy négytagú családot egész évben energiával és hővel ellátni.

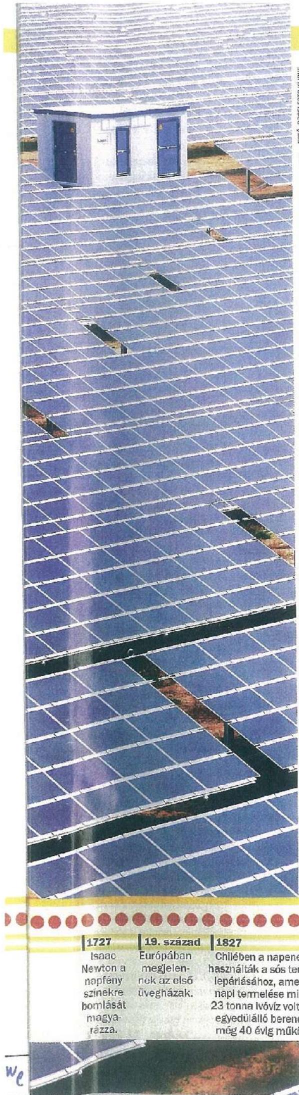
Villamos energia 15 000 háztartás részére

A becslések szerint az új erőmű élettartama húsz év és 15 000 háztartást lát majd el árammal. Ez nem éppen fergeteges érték, ha mondjuk azt nézzük, hogy a Biblis német atomerőmű áramszolgáltatása 6,5 millió háztartásnak elegendő. Ennek ellenére nyilvánvaló, hogy a napenergiának is lehet jövője. Persze most bárki felemelheti a szavát, mondván, hogy a naperőmű ugyan természetbarát, de mindamellett a természetből igen nagy területet vesz el. Így van, de éppen ezért általában sivatagban építik, ahol az eredeti élőhelyeket viszonylag kevéssé veszélyeztetik és még a napsugárzás intenzitása is nagyobb. Annak is megvan az oka, hogy a branderburgi erőmű is pontosan ott épült, ahol épült. A szovjet csapatok ugyanis ezt a területet olyan nagy mértékben árasztották el olajjal és egyéb, különböző vegyi anyagokkal, hogy a terület újra művelése hosszú évtizedek kérdése.

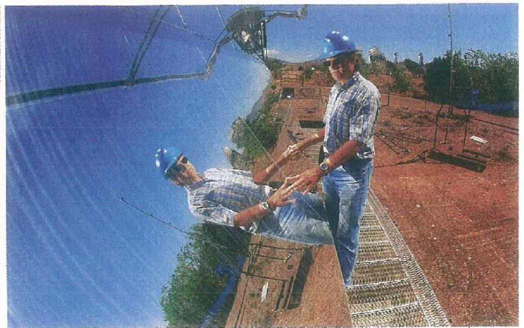
560 000 napelem

A tervek szerint ezen a területen nem áll majd örökké a naperőmű. Húsz év múlva ide újra visszatér a növényzet. A naperőmű egyidejűleg jelentősen megőrzi a levegő tisztaságát, mert a klasszikus szénerőmű, azonos mennyiségű villanyáram termelés mellett, évente 35 000 tonna szén-dioxidot bocsátana a levegőbe.

A napelemeket a First Solar amerikai társaság szállította. Vékonyak és számuk nem kevesebb mint 560 000 darab. A német gazdaság számára bizonyára érdekes volt, hogy nem az óceánon túl gyártották, hanem az Odera-i Frankfurtban. *„Az új energia még nincs szétosztva. Kelet-Németország ezen a téren az első befutó"* – említette ezzel kapcsolatban Wolfgang Tiefensee, szövetségi építésügyi miniszter. Az igazság viszont az, hogy a napenergiát hasznosító berendezések gyártásában lassan, de biztosan Kína nyeri el a vezető szerepet, főként az ottani alacsony gyártási költségek miatt.



FOTÓ: PROFIFOTO/ALIGHE



» **A világ legnagyobb naperőműve a Mojave-sivatagban található**

FOTÓ: CLEANTECHNICA.COM

A Napnak elébe

Egyébként a németek a napenergiából termelt villanyáramot komolyan gondolják. Kétmillió napelemes berendezés működik és a 2004. augusztus 1-jén életbe lépett törvény kötelezi a villamosenergia-szolgáltatókat, hogy a naperőművekből vegyék át az áramot és 20 évig, változatlan ár mellett értékesítsék. Németországban azonban a napenergia mellékes forrás, és a jelenlegi teljes áramfogyasztásban kevesebb, mint egy százalékkal vesz részt.

Ezt felülmúlja a szél- és a biomasszából nyert energia is. A Lieberose erőmű teljes kapacitása 53 000 kilowatt, vagyis 53 megawatt. (Összehasonlításul megemlítjük, hogy a paksi atomerőmű négy reaktorából egyetlennek is 500 megawatt a teljesítménye.) Az építési költségek elérték a 235 millió eurót. A befektetésben nagymértékben részt vállalt a magánszektor is. «

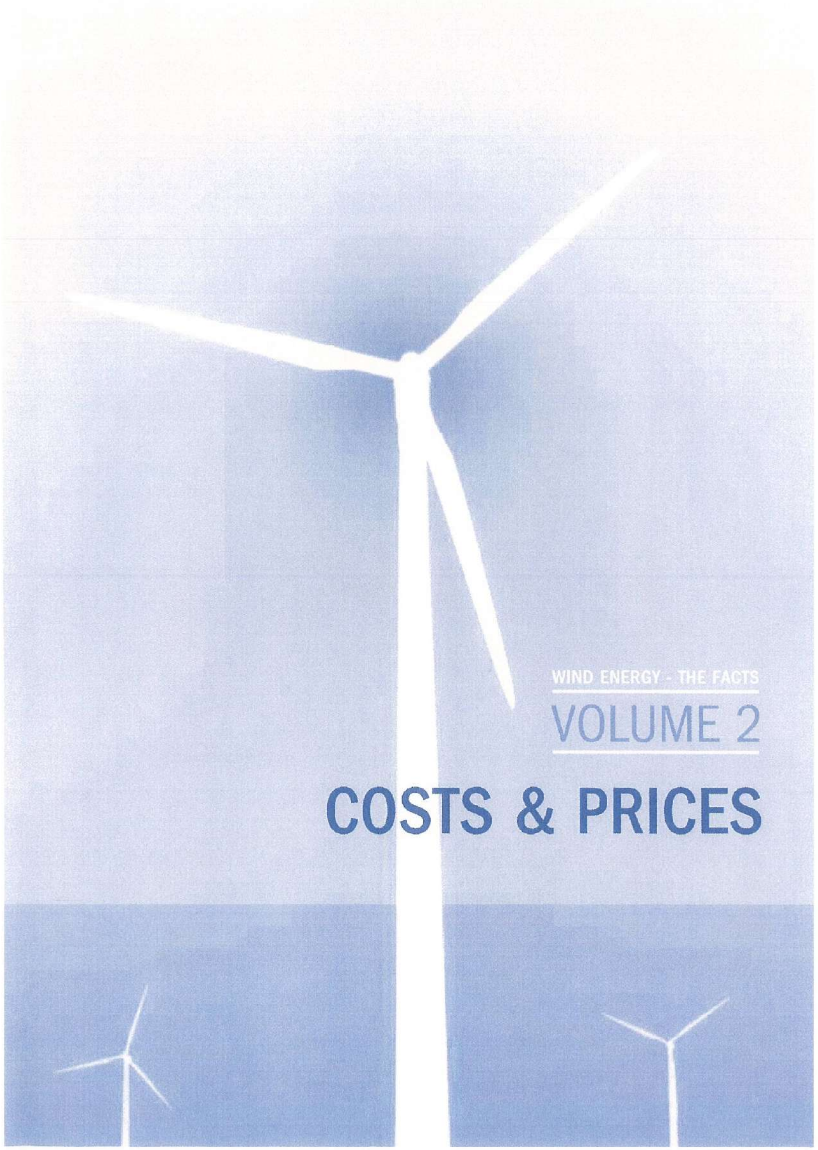
Kun Márton

HOGYAN TANULTA MEG AZ EMBER HASZNOSÍTANI A NAPOT?

4,5 milliárd év	Az első sugarak az eddig sötét és hideg Földre hullnak. Az élet és fotoszintézis hajtóereje.
7. század	Az asszírok a tűzrakáshoz csiszolt kristályos lencsén összpontosított napsugarakat használnak.
4. század	A görögök napórát használnak.
időszámításunk kezdete	
1. század	Ifj. Plinius üvegből passzív „napenergia" házat építtet. Ez a technika lehetővé tette, hogy a ház lakóterében állandó hőmérséklet legyen.
14. század	Az indián kultúra népei olyan építményekben laktak, amelyek homlokzata dél felé irányult, és idesütött a téli nap. A falak kőből és szárított téglából készültek.
1556	G. Fabricius tanító és költő ezüst-kloriddal végzett kísérlete közben megállapította, hogy a napfény képes vegyi reakció kiváltására.
18. század	A francia vegyész, Antoine Lavoisier napkemencét épít platina olvasztására.
1727	Isaac Newton a napfény színekre bomlását magyarázza.
19. század	Európában megjelennek az első üvegházak.
1827	Chilében a napenergiát használták a sós tengervíz lepárlásához, amelynek napi termelése mintegy 23 tonna ivóvíz volt. Ez az egyedülálló berendezés még 40 évig működött.
1884	August Mouchot francia tudós napenergián alapuló gőzgépet épít.
1908	A Carnegie Steel amerikai társaság bemutatta a napkollektort, amely a házakon is elhelyezhető.
1941	Florida államban bevezetik a szoláris vízmelegítőket.
1950	Frank Bridgers építész irodaházat tervez, amelyet napenergiával fűtenek. Ez az első épület, amely kihasználja a napsugárzást.
1958	Napelemeket használnak az űrkutatásban.

ILLUSZTRÁCIÓ ÉS FOTÓ: LOUIS JEAN DESIRE DELAISTRE, PD-US ÉS CNIMSY.COM

CHINA:
SOLAR: GERMANY'S LIEBEROSE: 235,000,000 / 53 MWe = 4,434,000



Acknowledgments

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CONGRESS OF THE UNITED STATES
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A CBO STUDY

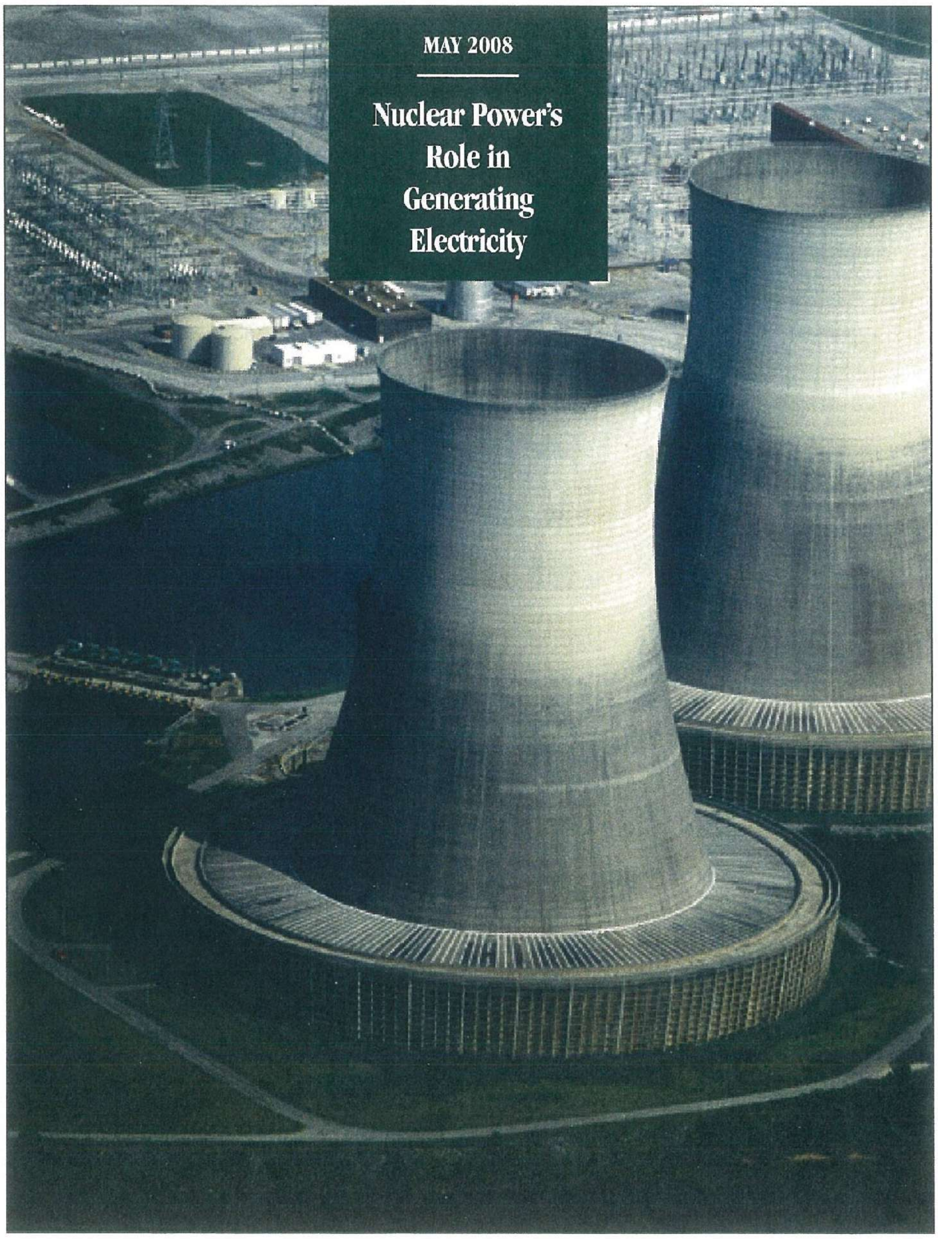


Table 2-1.

Projected and Actual Construction Costs for Nuclear Power Plants

Construction Starts		Average Overnight Costs[a]		
Year Initiated	Number of Plants[b]	Utilities' Projections (Thousands of dollars per MW)	Actual (Thousands of dollars per MW)	Overrun (Percent)
1966 to 1967	11	612	1,279	109
1968 to 1969	26	741	2,180	194
1970 to 1971	12	829	2,889	248
1972 to 1973	7	1,220	3,882	218
1974 to 1975	14	1,263	4,817	281
1976 to 1977	5	1,630	4,377	169
Overall Average	**13**	**938**	**2,959**	**207**

Source: Congressional Budget Office (CBO) based on data from Energy Information Administration, *An Analysis of Nuclear Power Plant Construction Costs,* Technical Report DOE/EIA-0485 (January 1, 1986).

Notes: Electricity-generating capacity is measured in megawatts (MW); the electrical power generated by that capacity is measured in megawatt hours (MWh). During a full hour of operation, 1 MW of capacity produces 1 MWh of electricity, which can power roughly 800 average households.

The data underlying CBO's analysis include only plants on which construction was begun after 1965 and completed by 1986.

Data are expressed in 1982 dollars and adjusted to 2006 dollars using the Bureau of Economic Analysis's price index for private fixed investment in electricity-generating structures. Averages are weighted by the number of plants.

a. Overnight construction costs do not include financing charges.

b. In this study, a nuclear power plant is defined as having one reactor. (For example, if a utility built two reactors at the same site, that configuration would be considered two additional power plants.)

cost overruns exceeded 250 percent.[3] (An average of 12 years elapsed between the start of construction and the point at which the plants began commercial operation. The overruns in overnight costs did not include additional financing costs that were attributable to post-accident construction delays.)[4]

The base-case assumption adopted in this analysis for nuclear power plants' overnight costs recognizes that history but also allows for countervailing factors, such as changes in the U.S. regulatory process and other countries' recent experience with new reactor designs. In 1989, the Nuclear Regulatory Commission developed an alternative process for obtaining the licensing necessary to operate a nuclear power plant. That revised process is intended to reduce cost uncertainties by allowing utilities to fulfill more regulatory requirements before beginning construction, thereby reducing midconstruction design changes that contributed to overruns in the past.

The experience of a Japanese utility, the Tokyo Electric Power Company (TEPCO), in the mid-1990s also appears to support CBO's base-case assumption about construction costs. According to the 2003 MIT study, verifiable data indicate that TEPCO constructed two advanced boiling-water reactors at costs and schedules close to manufacturers' estimates.[5] However, a Finnish utility that is building a reactor based on a different design, an advanced pressurized-water reactor, continues to have difficulty adhering to original cost estimates. By

3. The calculation is based on data from Energy Information Administration, *An Analysis of Nuclear Power Plant Construction Costs,* DOE/EIA-0485 (1986). Those data include only plants on which construction was begun after 1965 and completed by 1986.

4. See Pietro S. Nivola, "The Political Economy of Nuclear Energy in the United States," *Brookings Policy Brief No. 138* (September 2004).

5. See Deutch and others, *The Future of Nuclear Power,* p. 142.

CBO

Table 2-2.

Financial Risk Assumptions in Comparable Studies

Study	Real Rate of Return (Percent)	Capital Recovery Period[a] (Years)
CBO	8-3/4 – 12-1/2	40
EIA	9-1/4	20
IEA	8 – 11	40 – 25
MIT	8 – 11-1/4	25 – 40

Source: Congressional Budget Office (CBO).

Notes: EIA = Energy Information Administration; IEA = International Energy Agency; MIT = Massachusetts Institute of Technology.

Real rates of return are rounded to the nearest quarter of a percentage point. CBO calculated those rates on the basis of the inflation rates and nominal rates of return used in each study. The underlying nominal rates of return for the studies conducted by EIA and IEA represent the weighted average cost of capital assumed in those studies. The nominal rates of return for the MIT study were constructed by taking the ratio of financing charges to balances in CBO's replication of the MIT model.

a. The capital recovery period represents the number of years over which revenue from the sale of electricity is used to repay debt or equityholders.

2007, that project, initially estimated to cost €3 billion, had fallen at least 18 months behind schedule, causing costs to increase by €700 million.[6]

Financing Costs

Even if construction proceeds on schedule, utilities still incur substantial financing costs because power plants take years to build, and financing costs for construction extend over the decades that a plant generates electricity. CBO's assumptions about financing costs are a synthesis of the financial analyses presented in the studies by EIA and MIT. Those assumptions are encapsulated by the real rate of return that investors require to assume the risk of paying up-front construction costs.[7] CBO used a real rate of return of 10 percent, which falls within the range of rates of return given in the other studies (see Table 2-2).[8] The 10 percent rate of return was used for each technology, reflecting that the level of financial risk is similar across commercially viable projects. The MIT study assumed that a higher rate of return would be required for nuclear technology than for conventional fossil-fuel technologies; however, that 2003 study was published before much of the volatility in natural gas prices and when future federal carbon dioxide constraints may have appeared less likely.[9] But nuclear plants could still be a riskier investment than competing alternatives, or the rate of return could vary for all technologies. In addition to the base-case assumption of a 10 percent rate of return, CBO considered the competitiveness of nuclear power under lower and higher rates (as shown in Table 2-2).

Fuel Costs

The cost of fuel is one of the most significant operating costs included in CBO's estimates of the levelized cost of options for generating electricity. The base-case assumption for nuclear power is that $8 (in 2006 dollars) in fuel costs are incurred for each megawatt hour of electricity generated (see Table 2-3). That contrasts with $16 for conventional coal-fired plants and $40 for conventional natural gas plants.[10] Those assumptions are based on long-term projections by EIA. In the past, fuel costs have proved difficult to predict, particularly the price of natural gas. (See Figure 2-1 for fluctuations in fuel prices between 1995 and 2006.) In addition to those base-case assumptions, CBO also estimated levelized costs using alternative assumptions intended to capture most plausible variations in fuel costs.

6. See David Gauthier-Villars, "Trials of Nuclear Rebuilding: Problems at Finland Reactor Highlight Global Expertise Shortage," *Wall Street Journal*, March 3, 2007, p. A6.

7. Financing costs are also influenced by the period of capital recovery—the number of years over which the plant generates revenue for equityholders. As the recovery period increases, so do the financing costs.

8. The 10 percent rate of return is based on 45 percent debt financing and 55 percent equity financing. Debt is assumed to be repaid at a rate of return of 8 percent over 20 years, and equity is assumed to be repaid at an average rate of return of 14 percent over the 40 years the plant is assumed to operate.

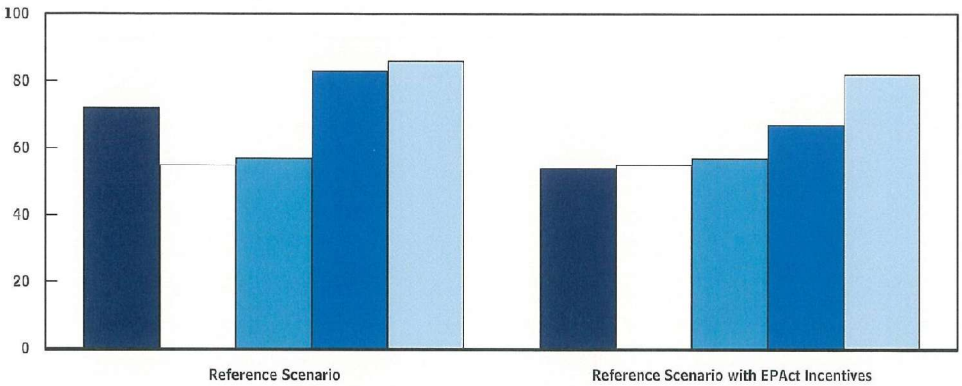
9. See "Coal Utilities Say They Do Not Fear Risk to Credit, Despite Moody's Warning on Carbon Burdens," *Platts Electric Utility Week* (March 3, 2008), p. 1. According to that report, Moody's Investors Services has warned that the prospect of future carbon dioxide charges may adversely affect the credit rating of utilities and thus raise the cost of capital for investment in conventional coal-fired generation.

10. Fuel costs at innovative fossil-fuel plants are expected to be 10 percent to 30 percent higher because additional energy is needed to capture carbon dioxide.

Figure 3-3.

Levelized Cost of Alternative Technologies to Generate Electricity With and Without EPAct Incentives

(2006 dollars per megawatt hour)



Source: Congressional Budget Office (CBO).

Notes: CBO's reference scenario excludes both the effects of prospective carbon dioxide constraints and the impact of incentives provided by the Energy Policy Act of 2005 (EPAct). The estimate of the effect of EPAct incentives assumes the maximum production tax credits, loan guarantees, and investment tax credits. The production tax credits are shared among 6,000 megawatts or less of advanced nuclear capacity. Advanced nuclear and innovative fossil fuel technologies receive loan guarantees covering 80 percent of construction costs. Innovative coal technology receives investment tax credits for 20 percent of construction costs.

Electricity-generating capacity is measured in megawatts; the electrical power generated by that capacity is measured in megawatt hours. During a full hour of operation, 1 megawatt of capacity produces 1 megawatt hour of electricity, which can power roughly 800 average households.

Advanced nuclear technology refers to third-generation reactors. Conventional coal power plants are assumed to use pulverized coal technology, which produces energy by burning a crushed form of solid coal. Conventional natural gas power plants are assumed to convert gas into electricity using combined-cycle turbines. Both innovative coal and innovative natural gas technologies are assumed to capture and store most carbon dioxide emissions.

The effect of the production tax credits on levelized costs would be smaller if more than 6,000 megawatts of qualified nuclear capacity (equivalent to the output of three to five plants) was constructed; but construction of more capacity would indicate that nuclear technology did not require the full allotment of credits to be commercially viable.

Because the credits would not be used until after a plant began operating—in other words, once electricity had been sold and the utility had incurred sufficient tax liability—the reduction in the levelized cost of generating electricity for qualifying nuclear plants would necessarily be less than the nominal value of the credits awarded to each project. Thus, even though credits of $18 per megawatt hour of generated electricity are equal to about one-quarter of the levelized cost estimated in the reference scenario, after discounting, the credits would reduce the cost of nuclear capacity by only about 15 percent if they were used within three years of being awarded.

The Economics of Nuclear Power

(*January 2010*)

- **Nuclear power is cost competitive with other forms of electricity generation, except where there is direct access to low-cost fossil fuels.**
- **Fuel costs for nuclear plants are a minor proportion of total generating costs, though capital costs are greater than those for coal-fired plants and much greater than those for gas-fired plants.**
- **In assessing the economics of nuclear power, decommissioning and waste disposal costs are taken into account.**

The relative costs of generating electricity from coal, gas and nuclear plants vary considerably depending on location. Coal is, and will probably remain, economically attractive in countries such as China, the USA and Australia with abundant and accessible domestic coal resources as long as carbon emissions are cost-free. Gas is also competitive for base-load power in many places, particularly using combined-cycle plants, though rising gas prices have removed much of the advantage.

Nuclear energy is, in many places, competitive with fossil fuel for electricity generation, despite relatively high capital costs and the need to internalise all waste disposal and decommissioning costs. If the social, health and environmental costs of fossil fuels are also taken into account, the economics of nuclear power are outstanding.

See also the December 2005 World Nuclear Association report (pdf 310 kB) The New Economics of Nuclear Power.

External costs

The report of a major European study of the external costs of various fuel cycles, focusing on coal and nuclear, was released in mid 2001 - ExternE. It shows that in clear cash terms nuclear energy incurs about one tenth of the costs of coal. The external costs are defined as those actually incurred in relation to health and the environment and quantifiable but not built into the cost of the electricity. If these costs were in fact included, the EU price of electricity from coal would double and that from gas would increase 30%. These are without attempting to include the external costs of global warming.

The European Commission launched the project in 1991 in collaboration with the US Department of Energy, and it was the first research project of its kind "to put plausible financial figures against damage resulting from different forms of electricity production for the entire EU". The methodology considers emissions, dispersion and ultimate impact. With nuclear energy the risk of accidents is factored in along with high estimates of radiological impacts from mine tailings (waste management and decommissioning being already within the cost to the consumer). Nuclear energy averages 0.4 euro cents/kWh, much the same as hydro, coal is over 4.0 cents (4.1-7.3), gas ranges 1.3-2.3 cents and only wind shows up better than nuclear, at 0.1-0.2 cents/kWh average. NB these are the external costs only.

The cost of fuel

Understanding the cost of new generating capacity and its output requires careful analysis of what is in any set of figures. There are three broad components: capital, finance and operating costs. Capital and financing costs make up the project cost.

-- **Capital cost** may comprise several things: the bare plant cost (usually identified as engineering-procurement-construction - EPC - cost), the owner's costs (land, cooling infrastructure, administration and associated buildings, site works, switchyards, project management, licences, etc), cost escalation and inflation. (Owner's costs may include transmission infrastructure, though strictly this is extrinsic.) The term "overnight capital cost" is often used, meaning EPC plus owners costs and excluding financing, escalation due to increased material and labour costs, and inflation. Construction cost – sometimes called "all-in cost", adds to overnight cost any escalation and interest during construction and up to the start of construction. It is expressed in the same units as overnight cost and is useful for identifying the total cost of construction and for determining the effects of construction delays.

-- **Financing costs** will depend on the rate of interest on debt, the debt-equity ratio, and if it is regulated, how the capital costs are recovered.

-- **Operating costs** include operating and maintenance (O&M) plus fuel, and need to allow for a return on equity.

Any capital cost figures from a rector vendor, or which are general and not site-specific, will usually just be for EPC costs. This is because owner's costs will vary hugely, most of all according to whether a plant is Greenfield or at an established site, perhaps replacing an old plant.

A 2005 **OECD comparative study** showed that nuclear power had increased its competitiveness over the previous seven years. The principal changes since 1998 were increased nuclear plant capacity factors and rising gas prices. The study did not factor in any costs for carbon emissions from fossil fuel generators, and focused on over one hundred plants able to come on line 2010-15, including 13 nuclear plants. Nuclear overnight construction costs ranged from US$ 1000/kW in Czech Republic to $2500/kW in Japan, and averaged $1500/kW. Coal plants were costed at $1000-1500/kW, gas plants $500-1000/kW and wind capacity $1000-1500/kW.

OECD electricity generating cost projections for year 2010 on - 5% discount rate

	nuclear	coal	gas
Finland	2.76	3.64	-
France	2.54	3.33	3.92
Germany	2.86	3.52	4.90
Switzerland	2.88	-	4.36
Netherlands	3.58	-	6.04
Czech Rep	2.30	2.94	4.97
Slovakia	3.13	4.78	5.59
Romania	3.06	4.55	-
Japan	4.80	4.95	5.21
Korea	2.34	2.16	4.65
USA	3.01	2.71	4.67
Canada	2.60	3.11	4.00

US 2003 cents/kWh, Discount rate 5%, 40 year lifetime, 85% load factor.
Source: OECD/IEA NEA 2005.

as seen above in Capital Costs, this figure is subject to debate, as much higher cost was found for recent projects.[citation needed] Also, carbon taxes and backup power costs were not considered.[47]

A May 2008 study by the Congressional Budget Office concludes that a carbon tax of $45 per metric ton would probably make nuclear power cost competitive against conventional fossil fuel for electricity generation.[48]

Costs for Clean coal and Carbon capture and storage can be found in those articles.

Estimates of total lifetime energy returned on energy invested vary greatly depending on the study. An overview can be found here (Table 2):[49]

The effect of subsidies is difficult to gauge, as some are indirect (such as research and development). A May 12, 2008 editorial in the *Wall Street Journal* stated, "For electricity generation, the EIA(Energy Information Administration, an office of the Department of Energy) concludes that solar energy is subsidized to the tune of $24.34 per megawatt hour, wind $23.37 and 'clean coal' $29.81. By contrast, normal coal receives 44 cents, natural gas a mere quarter, hydroelectric about 67 cents and nuclear power $1.59."[50]

Other economic issues

Nuclear Power plants tend to be very competitive in areas where other fuel resources are not readily available — France, most notably, has almost no native supplies of fossil fuels.[51]

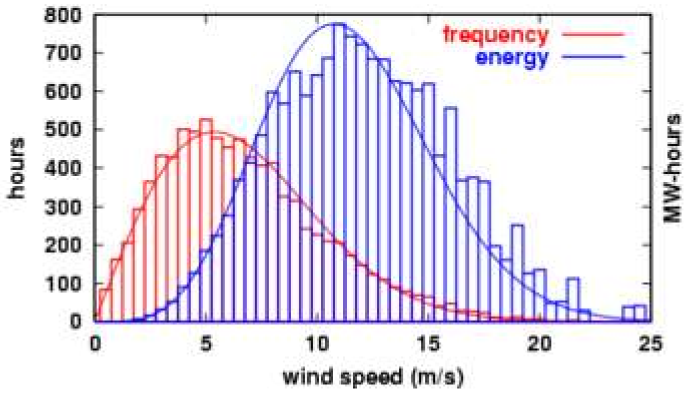
Making a massive investment of capital in a project with long-term recovery might impact a company's credit rating.[52]

Any effort to construct a new nuclear facility around the world, whether an existing design or an experimental future design, must deal with NIMBY or NIABY objections. Because of the high profiles of the Three Mile Island accident and Chernobyl disaster, relatively few municipalities welcome a new nuclear reactor, processing plant, transportation route, or nuclear burial ground within their borders, and some have issued local ordinances prohibiting the locating of such facilities there. However, a number of U.S. areas, some already with nuclear units, are campaigning for more (see Nuclear Power 2010 Program).

A Council on Foreign Relations report on nuclear energy argues that a rapid expansion of nuclear power may create shortages in building materials such as reactor-quality concrete and steel, skilled workers and engineers, and safety controls by skilled inspectors. This would drive up current prices.[53] It may be easier to rapidly expand, for example, the number of coal power plants, without this having a large effect on current prices.

The number of companies that manufacture certain parts for nuclear reactors is limited, particularly the large forgings used for reactor vessels and steam systems. Only four companies (Japan Steel Works, China First Heavy Industries, Russia's OMX Izhora and Korea's Doosan Heavy Industries) currently manufacture pressure vessels for reactors of 1100 MWe or larger.[54][55] Some have suggested that this http://en.wikipedia.org/wiki/Wind_power

Slide 10



Distribution of wind speed (red) and energy (blue) for all of 2002 at the Lee Ranch facility in Colorado. The histogram shows measured data, while the curve is the Rayleigh model distribution for the same average wind speed. Energy is the Betz limit through a 100 m (328 ft) diameter circle facing directly into the wind. Total energy for the year through that circle was 15.4 gigawatt-hours (GW·h).

The Earth is unevenly heated by the sun, such that the poles receive less energy from the sun than the equator; along with this, dry land heats up (and cools down) more quickly than the seas do. The differential heating drives a global atmospheric convection system reaching from the Earth's surface to the stratosphere which acts as a virtual ceiling. Most of the energy stored in these wind movements can be found at high altitudes where continuous wind speeds of over 160 km/h (99 mph) occur. Eventually, the wind energy is converted through friction into diffuse heat throughout the Earth's surface and the atmosphere.

The total amount of economically extractable power available from the wind is considerably more than present human power use from all sources.[8] An estimated 72 terawatt (TW) of wind power on the Earth potentially can be commercially viable,[9] compared to about 15 TW average global power consumption from all sources in 2005. Not all the energy of the wind flowing past a given point can be recovered (see Betz' law).

Distribution of wind speed

The strength of wind varies, and an average value for a given location does not alone indicate the amount of energy a wind turbine could produce there. To assess the frequency of wind speeds at a particular location, a probability distribution function is often fit to the observed data. Different locations will have different wind speed distributions. The Weibull model closely mirrors the actual distribution of hourly wind speeds at many locations. The Weibull factor is often close to 2 and therefore a Rayleigh distribution can be used as a less accurate, but simpler model.

Because so much power is generated by higher wind speed, much of the energy comes in short bursts. The 2002 Lee Ranch sample is telling;[10] half of the energy available arrived in just 15% of the operating time. The consequence is that wind energy from a particular turbine or wind farm does not have as consistent an output as fuel-fired power plants; utilities that use wind power provide power from starting existing generation for times when the wind is weak thus wind power is primarily a fuel saver rather than a capacity saver. Making wind power more consistent requires that various existing technologies and methods be extended, in particular the use of stronger inter-regional transmission lines to link widely distributed wind farms.

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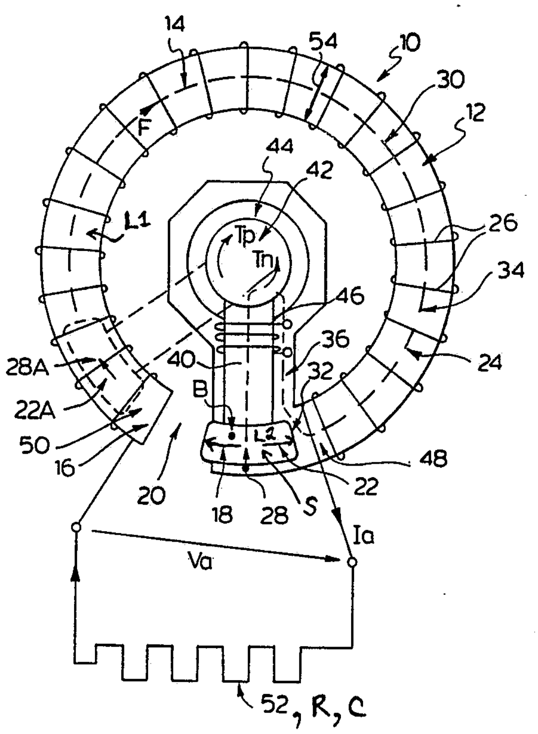

(57) Abstract

An asymmetrical, electro-mechanical device (10) comprises a geometrically-magnetically-asymmetrical stator (12) and a rotor (22) which move with respect to each other. There is a stator air gap (20) which makes the stator (12) asymmetrical. The magnetic flux passing from the rotor (22) to the stator (12) is interrupted when the rotor (22) passes by the stator air gap (20). The invention is able to achieve improvements over the prior art electro-mechanical devices, particularly in respect of efficiency.

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ASYMMETRICAL ELECTRO-MECHANICAL DEVICE a.k.a. CDCII

BACKGROUND OF THE INVENTION

This invention relates to an asymmetrical, electro-mechanical device which may act as a motor or a generator. In particular, the invention relates to an improved and efficient generator/motor.

Of course, electro-mechanical devices which act as motors and generators are known. However, it is always important to improve upon the prior electro-mechanical devices and, in particular, to improve the efficiency of those devices.

SUMMARY OF THE INVENTION

Accordingly, it is an object of this invention to at least partially improve upon the prior art devices, particularly by improving the efficiency of the prior art devices. Also, it is an object of this invention to provide an alternative type of electro-mechanical device, namely an asymmetrical electro-mechanical device.

Accordingly, in one of its broad aspects, this invention resides in providing an asymmetrical, electro-mechanical device comprising:

(a) a geometrically-magnetically-asymmetrical stator means comprising:

a non-continuous stator magnetic flux path extending from a first stator portion to a second stator portion;

stator air gap extending from the second stator portion to the first stator portion; and a stator face having a plurality of armature conductors extending substantially transversely across the stator face;

(b) a rotor means having a rotor face and moving along a rotor movement path;

(c) a rotor/stator air gap between the rotor face and the stator face when the rotor face and the stator face are adjacent each other;

(d) a continuous magnetic flux path extending along at least a portion of the stator magnetic flux path, through the stator face, through the rotor/stator air gap, into or out of the rotor face, through the rotor means, and through at least one magnetic flux connecting means which enables the magnetic flux path to be continuous;

(e) magnetic flux generating means for generating magnetic flux to pass through the continuous magnetic flux path;

(f) wherein the rotor means is capable of cyclically moving relative to the stator means in a direction along a rotor movement path which is outside of the stator magnetic flux path, wherein:

(i) a first part of the rotor movement path is adjacent to the stator magnetic path, and a second part of the rotor movement path is not adjacent to the stator magnetic path such that magnetic flux, except magnetic flux leakage, cannot pass through the rotor face to or from the stator magnetic flux path;

(ii) beginning at time zero until time critical, the rotor face moves away from both a first portion of the stator face and the stator magnetic flux path such that magnetic flux, except magnetic flux leakage, does not pass through the rotor face into or out of the stator magnetic flux path, then toward a second portion of the stator face, and then such that the rotor face is adjacent to and overlapping with the stator face such that operational magnetic flux passes through the rotor face into or out of the stator magnetic flux path;

(iii) at time critical, the rotor face moves into a position of maximal overlap with the stator face; and

(iv) from time critical until time end of cycle, the rotor face moves along at least a portion of the stator face and adjacent to the stator face in a direction of the stator magnetic path;

(g) wherein when the rotor face and the stator face move relative to and adjacent to each other an armature electric voltage and armature current having directions are developed in the plurality of armature conductors; and

(h) wherein when the plurality of armature conductors is closed or under load, the direction of the armature current reverses at time critical when the rotor face moves into a position of maximal overlap with the stator face, without the magnetic flux reversing direction and without the rotor means reversing direction.

Further aspects of the invention will become apparent upon reading the following detailed description and the drawings which illustrate the invention and preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, which illustrate embodiments of the invention:

Figure 1 is a schematic view of one embodiment of the invention;

Figure 2 is a schematic, perspective view of another embodiment of the invention;

Figure 3 is a schematic, top view of another embodiment of the invention;

Figure 4 is a schematic, perspective view of a further embodiment of the invention;

Figure 5 is a schematic, perspective view of yet a further embodiment of the invention; and

Figure 6 is a schematic, perspective view of yet a further embodiment of the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

As shown in Figure 1, an asymmetrical, electro-mechanical device 10 of the invention includes a geometrically-magnetically-asymmetrical stator 12. Although the word "stator" is used to describe this feature and other similar features in this disclosure and the claims, the "stator" need not be "stationary".

The stator 12 has a non-continuous stator magnetic flux path 14 extending from a first stator portion 16 to a second stator portion 18.

There is also a stator air gap 20 which extends from the second stator portion 18 to the first stator portion 16. The stator air gap 20 may be an absolute air gap in the sense that the stator 12 is physically and completely discontinuous at the stator air gap 20. However, the stator air gap 20 may also be an effective air gap in the sense that the stator, for example only, as shown in Figure 1, could go into the plane of the paper beginning at the second stator portion 18 and extend sufficiently far from the remainder of the stator 12 and then return to the first stator portion 16. In this manner, there would be an effective air gap between the second stator portion 18 and the first stator portion 16 when a rotor 22 passed along the stator from the second stator portion 18 to the first stator portion 16. A stator air gap will be created, whether actual or effective, when magnetic flux, except leakage flux, will not pass from the rotor 22, specifically the rotor face 28, to the stator 12.

On at least some portion of the stator 12 there is a stator face 24. The stator face 24 has a plurality of armature conductors 26 extending substantially transversely across the stator face 24. The armature conductors 26 are substantially transverse to the direction of the stator magnetic flux path 14.

In Figure 1, the armature conductors 26 are coiled around a toroidally-shaped stator 12.

The rotor 22 has a rotor face 28. The rotor face 28 faces the stator face 24.

The rotor 22 moves along a rotor movement path 30. Preferably the rotor movement path 30 follows as closely as possible the stator magnetic flux path 14.

A rotor/stator air gap 32 exists between the rotor face 28 and the stator face 24 when the rotor face 28 and the stator face 24 are adjacent to each other.

The device 10 also has a continuous magnetic flux path 34 extending along at least a portion of the stator magnetic flux path 15. In the embodiment shown in Figure 1, the continuous magnetic flux path 34 extends along the entire portion of the stator flux path 14 from the first stator portion 16 to the second stator portion 18. The length of the continuous magnetic flux path 34 is variable in time as the rotor 22 moves along the rotor movement path 30. This will be explained below.

The continuous magnetic flux path 34 passes through the rotor/stator air gap 32, through the stator face 24 and through at least one magnetic flux connecting means 36 which enables the continuous magnetic flux path 34 to be continuous.

In Figure 1, in the position where the rotor 22 is shown in solid lines, the continuous magnetic flux path 34 is very short. The continuous magnetic flux path 34 extends from the rotor face 28 through an arm 40 which connects the rotor face 28 to an input/output shaft 42. In this embodiment, the input/output shaft 42 is magnetically connected to the connecting means 36 by any appropriate means such as a friction fit (not shown), brushes (not shown), or an air gap 44.

In any case, the continuous magnetic flux path 34 passes from the rotor 22 (specifically from the rotor arm 40 in this embodiment) to the connecting means 36. The continuous magnetic flux path 34 then continues through the connecting means 36 to that portion of the stator face 24 which is immediately adjacent to the rotor face 28. The continuous magnetic flux path 34 which has just been described in association with the rotor 22 when it is in the position shown by solid lines in Figure 1 is essentially the shortest continuous magnetic flux path 34 which can be obtained in the embodiment shown in Figure 1.

The longest continuous magnetic flux path 34 which can be obtained in the embodiment of Figure 1 is shown when the rotor 22 is in the region of the first stator position 16 which is shown generally by the rotor 22A shown in dashed lines in Figure 1. In that embodiment, the portion of the continuous magnetic flux path 34 which extends through the stator flux path 14 extends from the position of the rotor face 28A (as shown with dashed lines in Figure 1) clockwise all the way around the stator flux path 14 to the second stator portion 18.

As the rotor 22 moves clockwise around the circular rotor movement path 30, the length of the actual continuous magnetic flux path 34 decreases.

There is also a magnetic flux generating means 46 for generating magnetic flux F. This magnetic flux passes through the continuous magnetic flux path 34. In Figure 1, the magnetic flux generating means 46 is a coil 46 around the rotor arm 40. However, any other suitable magnetic flux generating means could be used anywhere in the magnetic flux path 34.

The rotor 22 is capable of cyclicly moving relative to the stator 12. Once again, as discussed with respect to the stator, although the word "rotor" is used to describe this feature 22, the rotor need not rotate and it need not even move. The important point is that there is relative movement between the rotor 22 and the stator 12.

In the embodiment of Figure 1, the rotor 22 moves in a direction (as shown by the arrow on the dashed representation of the rotor 22A in Figure 1) along the rotor movement path 30. The rotor movement path 30 is outside of the stator magnetic flux path 14. In essence, the rotor movement path 30 does not cross through and is not positioned within the stator magnetic flux path 14.

A first part of the rotor movement path 30 is adjacent to the stator magnetic path 14, preferably adjacent the stator face 24. In that way, a rotor/stator air gap 32 can be created and the continuous magnetic flux path 34 can be created. In Figure 1, this first part of the rotor movement path corresponds to the movement of the rotor from a position adjacent to the first stator position 16 to a position adjacent to the second stator portion 18.

There is also a second part of the rotor movement path 30 which is not adjacent to the stator magnetic path 14 such that the magnetic flux F, except for magnetic flux leakage, does not pass through the rotor face 28 to or from the stator magnetic flux path 14. In other words, during the second part of the rotor movement path 30, the rotor face is in such a position such that there is no continuous magnetic flux path 34 or otherwise in that particular position. This is accomplished by having the second part of the rotor movement path 30 pass by or through the stator air gap 20.

The second part of the rotor movement path 34, in the embodiment shown in Figure 1, is part of the rotor movement path 30 from the second stator flux portion 18 to the first stator portion 16. In other words, the second part of the rotor movement path 30 is when the rotor face 28 passes through or over the stator air gap 20.

Beginning at a time zero until a time critical, the rotor face 28 moves away from both a first portion 48 of the stator face 24 and the stator magnetic path 14. In the embodiment shown in Figure 1, the first part 48 of the stator face 24 corresponds to the second stator portion 18. This is because the stator face 24 in Figure 1 includes substantially all of the stator 14. However, it would be possible to have the armature conductors 26 extend only around a portion of the toroidally-shaped stator 14. In that situation, the first part 48 of the stator face 24 (which is really an end of the stator face 24) would not correspond to the first and second stator portions 16, 18.

During at least part of this time zero to time critical, magnetic flux F, except magnetic flux leakage, does not pass through the rotor face 28 into or out of the stator magnetic flux path 14. Therefore, during at least part of this time zero to time critical, there is no flux F, except leakage flux, passing through the continuous magnetic flux path 34.

During this time zero to time critical, after the rotor face 28 moves away from the first portion 48 of the stator face 24, the rotor face 28 moves towards a second portion 50 of the stator face 24. Once again, in the embodiment shown in Figure 1, the second portion 50 of the stator face 24 corresponds to the first stator portion 16. This is because the armature conductors 26, as shown in Figure 1, are coiled substantially right to the end of the stator 14 where the stator air gap 20 begins. However, if the armature conductors 26 were not coiled right up to the end of the stator 14 at the stator air gap 20, the stator face 24 would have ended at a place different than the first stator means 16.

During this time zero to time critical, the rotor face 28 moves to a position adjacent to the second portion 50 of the stator face 24, and eventually overlaps with the second portion 50 of the stator face 24, such that operational magnetic flux F passes through the rotor face 28 into or out of the stator magnetic flux path 14. Thus, the continuous magnetic flux path 34 is brought into existence.

At time critical, the rotor face 28 moves into a position of maximum overlap with the stator face 24. In Figure 1, time critical occurs when the rotor 22A is in the position shown by dashed lines.

From time critical until time end of cycle, the rotor face 28 moves along at least a portion of the stator face 24 and adjacent to the stator face 24 in a direction of the stator magnetic flux path 14.

When the rotor face 28 and stator face 24 move relative to and adjacent to each other, an armature electric voltage Va and an armature current Ia having directions are developed in the plurality of armature conductors 26. In the embodiment shown in Figure 1, only the rotor 22 moves and the stator 14 remains stationary.

When the plurality of armature conductors 26 is closed or under load 52, the direction of the armature current Ia reverses at time critical when the rotor face 28 moves into a position of maximal overlap with the stator face 24, without the magnetic flux F reversing direction and without the rotor 28 reversing direction.

In the embodiment of the invention as shown in Figure 1, the stator is a toroidally-shaped body. A first end of the toroidally-shaped body corresponds to the first stator portion 16 and a second end of the toroidally-shaped body corresponds to the second stator portion 18. The stator extends toroidally for less than 360^{o} from the first end to the second end. The gap between the first and second ends of the toroidally-shaped body is the stator air gap 20.

As noted previously, in the embodiment shown in Figure 1, the conductors of the plurality of armature conductors 26 are coiled around the toroidally-shaped body. As shown, there is one continuous coil. However, it would be possible to have other arrangements of the armature conductor coils 26.

In the embodiment of Figure 1, the rotor 22 is connected by the rotor arm 40, which acts as a magnetic path connecting means, to complete the continuous magnetic flux path 34. The rotor 22 is connected to the input/output shaft 42 which is located concentrically within the toroidally-shaped stator 12.

In the embodiment shown in Figure 1, during the time from time zero to time critical, the rotor face 28 passes by the stator air gap 20 such that magnetic flux F, other than leakage flux, cannot pass through the rotor face 28 into or out of the stator magnetic flux path 14.

Another embodiment of the invention is shown in Figure 2. Respecting the embodiment of Figure 2, as well as in the embodiments of Figure 3, 4, 5 and 6, the numeric references will have three digits. The first digit will correspond to the particular Figure number and the last two digits will correspond to the numeric reference of the corresponding like feature in the embodiment described with reference to Figure 1.

In the embodiment of Figure 2, as well as in the embodiments of Figure 3, 4, 5 and 6, when the rotor face 228 and stator face 224 are adjacent to each other and overlap with each other, the rotor 222 is positioned between the stator face 224 and a second stator face 224′. The second stator face 224′ is spaced apart from the first stator face 224 such that a second rotor face 228′ on the rotor means 222 is adjacent to and overlaps the second stator face 224′.

As with the embodiments described in Figure 1, the stator face 224 has a first end 252 and a second end 254. Also, the second stator face 224′ has a first end 256 and a second end 258.

In this second embodiment, the non-continuous stator magnetic flux path 214 extends from the first end 252 of the first stator face 224 to the second end 254 of the first stator face 224. The non-continuous stator magnetic flux path 214 passes through a stator path member 260 extending from at least the second end 254 of the stator face 224 to the first end 256 of the second stator face 224′. The non-continuous stator magnetic flux path 214 then passes from the first end 256 of the second stator face 224′ to the second end 258 of the second stator face 224′. It will be understood that the stator path member 260 and the the non-continuous stator magnetic flux path 214 are arranged in a manner so as to not impede the relative movement between the rotor 222 and the stator 212.

In the embodiment shown in Figure 2, the rotor 222 may move in the direction shown as "D" in Figure 2. Similarly, the entire stator 212 may move and the rotor 222 may remain stationary.

While the rotor 222 is positioned between the first stator face 224 and the second stator face 224′, the continuous magnetic flux path 234 passes through the rotor 222.

The stator air gap in Figure 2 is shown as 220. The armature conductors are shown as 226 in Figure 2 and the magnetic flux generating means is shown as 246.

Although the second stator face 224′ is shown as being substantially in a plane parallel to the first stator face 224 in Figure 2, it is possible that the second stator face 224′ could be perpendicular to the first stator face 224 and come face to face with the rotor 222 in a region generally shown as P in Figure 2.

In a preferred embodiment of the invention, the Lorentz force equal to B.l.i does not create any more than a negligible negative torque on the input/output shaft connected to either of the moving rotor 12 or to the moving stator 12, if the stator moves. A negative torque is one which opposes the desired movement of the rotor 22 and is shown as Tn in the Figures.

In regard to this invention, "B" of the Lorentz force is a magnetic flux through the rotor/stator air gap 32. Also, "l" is the length of that portion of the armature conductor 26 passing across the stator face 24 and through the rotor/stator air gap 32. The length "l" is shown as reference 54 in Figure 1.

Also, "i" is the armature current Ia.

In a further preferred embodiment of the invention, the device 10 is operable such that between time zero and time critical, the armature current Ia creates a magnetic flux F in the stator magnetic flux path 14 which contributes to a positive torque Tp on the input/output shaft 42.

In a further preferred embodiment of the invention, the positive torque Tp described above, between time zero and time critical, is created when the following features of the device 10 are properly adjusted:

resistance R of the load 52 connected to the armature conductors 26;

capacitance C of the load 52;

length L1 from the first portion 48 of the stator face 24 to the second portion 50 of the stator face 24 during which the magnetic flux F, except magnetic flux leakage, does not pass through the rotor face 28 into or out of the stator magnetic flux path 14;

shape S of the rotor face 28; and

length L2 of the rotor face 28.

In a further specific embodiment of the invention, as shown in Figure 2, the first and second rotor faces 228, 228′ are in separate planes which are substantially parallel to each other. Also, the non-continuous stator magnetic flux path 214 comprises a first path member 262 extending from the second end 254 of the first stator face 224 in a plane substantially parallel to the plane of the first rotor face 222 to a second path member 264. The second path member 264 is part of the stator path member 260. The second path member 264 extends in a plane substantially perpendicular to the planes of the rotor faces 224 and 224′. The non-continuous stator magnetic flux path 214 further comprises the second path member 264 and a third path member 266 which extends from the second path member 264 in a plane substantially parallel to the plane of the second rotor face 228′ to the first end 256 of the second stator face 224′.

In a further preferred embodiment of the invention, as shown in Figure 3, each of the first and second rotor faces is configured in an arc in its respective plane. In Figure 3, which is a top view, there are actually two first rotor faces 328A and 328B shown. However, in one embodiment, there need only be one first rotor face 328A or 328B. It is preferred that there be at least two rotor faces 328A and 328B, in order that an embodiment as described below will be balanced. However, for the time being, consider, as this embodiment of the invention only, the rotor 322A and stator 312A.

In this embodiment, the rotor 322A rotates around the input/output shaft 342 in a circular path 330. Also, each of the first and second stator faces 328A and 328A′ (not shown) is configured in an arc along at least a part of the circular path of the rotor 322A.

Essentially, the rotor 322A and the stator 312A in Figure 3 is a top view of a specific embodiment of the more-general embodiment shown in Figure 2.

In a further embodiment of the invention, two of the devices 310A and 310B are combined. The two devices 310A and 310B are similar electro-magnetic devices. The two devices 310A and 310B are configured such that the rotors 322A and 322B are magnetically insulated from the rotor 322B, 322A of the other device. The rotor 322A, 322B of each of the devices 310A, 310B is connected to a common input/output shaft 342 in a balanced configuration and rotates around the shaft 342 in a common circular path 330 such that the rotor 322A, 322B of each device 310A, 310B passes between the stator faces 324A, 324A′ and 324B, 324B′ of each of the other devices.

In another preferred embodiment of the invention, as shown in Figure 4, the device 410 has first and second rotor faces 428 and 428′ which are spaced apart in a first direction FD. The first and second rotor faces 428, 428′ have curved surfaces which are substantially parallel to each other. The non-continuous stator magnetic flux path 414 comprises a first path member 462 extending from the second end 454 of the first stator face 424 in a plane substantially perpendicular to the surface of the first rotor face 428 to a second path member 464 extending in a direction substantially parallel to the first direction FD in which the rotor faces 424, 424′ are spaced apart.

The non-continuous stator magnetic flux path 414 also comprises the second path member 464 and a third path member 466 which extends from the second path member 464 in a plane substantially perpendicular to the plane of the second rotor face 424′ to the first end 456 of the second stator face 458.

In this embodiment, the rotor 422 rotates along the rotor movement path which is a circular path around the input/output shaft 442. Thus, the continuous magnetic flux path is in existence when the rotor 422 rotates such that the rotor faces 428, 428′ are adjacent to the stator faces 424, 424′.

In a further preferred embodiment of the invention, the rotor 422 moves relative to the stator 412 around the input/output shaft 442 in a circular path 430. Also, each of the first and second rotor faces 428, 428′ is positioned at substantially the same distance from the input/output shaft 442. Also, the length of each rotor face in the direction of the circular path is less than 360°.

In a further preferred embodiment of the invention, the rotor 422 is connected to and rotates with the input/output shaft 442 as shown in Figure 4. Also, the rotor 422 is positioned closer to the input/output shaft 442 than is the stator 412.

In a further preferred embodiment of the invention, as shown in Figure 5, there are at least two similar electro-magnetic devices 510A and 510B. However, for purposes of illustration, all of the stator 512B of device 510B is not shown. In this embodiment, the rotor 522 is positioned further from the input/output shaft 542 than is each of the stators 512A and 512B.

In this embodiment, each of the stators 510, 510B is connected to the input/output shaft 542. However, the rotor 522 could be configured so as to rotate around the shaft 542 and be connected to another shaft (not shown) which acts as an input/output shaft. For example, the shaft 542 could terminate as shown in Figure 5 and the shafts 568 and 570 could extend further and then be connected to radial spokes (not shown) which could be connected to a central longitudinal shaft (not shown) which acts as an input/output shaft.

In any case, it is preferred that the rotor 522 is positioned in a balanced configuration. Thus, a second rotor 522B could be positioned directly opposite the rotor 522. Alternately, a simple counterweight could be used to balance the rotor 522 in place of the second rotor 522B.

In any case, it is preferred that the rotor 522 moves in a circular path such that the first and second rotor faces 528A and 528A′ of device 510A and 528B and 528B′ of device 510B pass by the corresponding stator faces 524A and 524B of each of the other devices 510A, 510B.

Thus, in this particular embodiment, the flux connecting means 536A is connected by an additional flux connecting means 574 to the flux connecting means 536B of the device 510B. Thus, in this embodiment, there is a shared or common stator magnetic flux path 514.

In the embodiment shown in Figure 5, the two stators 512A and 512B are connected to the same input/output shaft 542.

In yet a further embodiment of the invention, each of the stator faces 524A and 524B has a length in the direction of the circular path of rotation of the stator faces 524A, 524B which is less than 360°. Preferably, the length is also greater than about 240°.

In a further preferred embodiment of the invention, as shown in Figure 6, the rotor means is connected to and rotates with the input/output shaft 642. Also, the rotor 622A is positioned closer to the input/output shaft 642 than is the stator 612A.

Moreover, the embodiment shown in Figure 6 includes a stationary flux connecting means 636 which includes a flux path which is common to both the stator flux path (not shown) of stator 612A and a second stator flux path (not shown) of a second stator (not shown).

It will be understood that, although various features of the invention have been described with respect to one or another of the embodiments of the invention, the various features and embodiments of the invention may be combined or used in conjunction with other features and embodiments of the invention as described and illustrated herein.

Although this disclosure has described and illustrated certain preferred embodiments of the invention, it is to be understood that the invention is not restricted to these particular embodiments. Rather, the invention includes all embodiments which are functional or mechanical equivalents of the specific embodiments and features that have been described and illustrated herein.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An asymmetrical, electro-mechanical device comprising:

(a) a geometrically-magnetically-asymmetrical stator means comprising:

a non-continuous stator magnetic flux path extending from a first stator portion to a second stator portion;

stator air gap extending from the second stator portion to the first stator portion; and

a stator face having a plurality of armature conductors extending substantially transversely across the stator face;

(b) a rotor means having a rotor face and moving along a rotor movement path;

(c) a rotor/stator air gap between the rotor face and the stator face when the rotor face and the stator face are adjacent each other;

(d) a continuous magnetic flux path extending along at least a portion of the stator magnetic flux path, through the stator face, through the rotor/stator air gap, into or out of the rotor face, through the rotor means, and through at least one magnetic flux connecting means which enables the magnetic flux path to be continuous;

(e) magnetic flux generating means for generating magnetic flux to pass through the continuous magnetic flux path;

(f) wherein the rotor means is capable of cyclically moving relative to the stator means in a direction along a rotor movement path which is outside of the stator magnetic flux path, wherein:

(i) a first part of the rotor movement path is adjacent to the stator magnetic path, and a second part of the rotor movement path is not adjacent to the stator magnetic path such that magnetic flux, except magnetic flux leakage, cannot pass through the rotor face to or from the stator magnetic flux path;

(ii) beginning at time zero until time critical, the rotor face moves away from both a first portion of the stator face and the stator magnetic flux path such that magnetic flux, except magnetic flux leakage, does not pass through the rotor face into or out of the stator magnetic flux path, then toward a second portion of the stator face, and then such that the rotor face is adjacent to and overlapping with the stator face such that operational magnetic flux passes through the rotor face into or out of the stator magnetic flux path;

(iii) at time critical, the rotor face moves into a position of maximal overlap with the stator face;

and

(iv) from time critical until time end of cycle, the rotor face moves along at least a portion of the stator face and adjacent to the stator face in a direction of the stator magnetic path;

(g) wherein when the rotor face and the stator face move relative to and adjacent to each other an armature electric voltage and armature current having directions are developed in the plurality of armature conductors; and

(h) wherein when the plurality of armature conductors is closed or under load, the direction of the armature current reverses at time critical when the rotor face moves into a position of maximal overlap with the stator face, without the magnetic flux reversing direction and without the rotor means reversing direction.

2. An electro-magnetic device as defined in claim 1 wherein:

the stator means is a toroidally-shaped body having a first end and a second end, and extending toroidally for less than 360′ from the first end to the second end;

the first and second ends of the toroidally-shaped body are the first and second stator portions, respectively, and the stator air gap is a gap between the second end and first end of the toroidally-shaped body;

the conductors of the plurality of armature conductors are coiled around the toroidally-shaped body;

the rotor means is connected by a first magnetic path connecting means to a shaft located concentrically within the toroidally-shaped stator means; and

during a time from time zero to time critical the rotor face passes by the stator air gap such that magnetic flux cannot pass through the rotor face into or out of the stator magnetic flux path.

3. An electro-magnetic device as defined in claim 1 wherein:

when the rotor face and stator face are adjacent to each other and overlapped with each other, the rotor means is positioned between the stator face and a second stator face which is spaced apart from the stator face such that a second rotor face on the rotor means is adjacent to and overlaps the second stator face;

the stator face has a first end and a second end;

the second stator face has a first end and a second end; and

the non-continuous stator magnetic flux path extends from the first end of the stator face to the second end of the stator face, through a stator path member extending from the second end of the stator face to the first end of the second stator face, and then from the first end of the second stator face to the second end of the second stator face in a manner so as to not impede the relative movement between the rotor means and the stator means.

4. An electro-magnetic device as defined in claim 2 wherein a Lorentz force equal to B.l.i does not create any more than a negligible negative torque on an input/output shaft connected to either the moving rotor means or the moving stator means,

where: "B" is magnetic flux through the rotor/stator air gap;
"l" is a length of that portion of the armature conductor passing across the stator face and through the rotor/stator air gap; and
"i" is the armature electric current.

5. An electro-magnetic device as defined in claim 4 wherein the device is operable such that between time zero and time critical the armature electric current creates a magnetic flux in the stator magnetic flux path contributing to a positive torque on the input/output shaft.

6. An electro-magnetic device as defined in claim 5 wherein the positive torque is created when the following features of the device are properly adjusted:

resistance of a load connected to the armature conductors;

capacitance of the load;

length from the first portion of the stator face to the second portion of the stator face during which the magnetic flux, except magnetic flux leakage, does not pass through the rotor face into or out of the stator magnetic flux path;

shape of the rotor face; and

length of the rotor face.

7. An electro-magnetic device as defined in claim 3 wherein a Lorentz force equal to B.l.i does not create any more than a negligible negative torque on an input/output shaft connected to either the moving rotor means or the moving stator means,

where: "B" is magnetic flux through the rotor/stator air gap;

"l" is a length of that portion of the armature conductor passing across the stator face and through the rotor/stator air gap; and

"i" is the armature electric current.

8. An electro-magnetic device as defined in claim 7 wherein the device is operable such that between time zero and time critical the armature electric current creates a magnetic flux in the stator magnetic flux path contributing to a positive torque on the input/output shaft.

9. An electro-magnetic device as defined in claim 8 wherein the positive torque is created when the following features of the device are properly adjusted:

resistance of a load connected to the armature conductors;

capacitance of the load;

length from the first portion of the stator face to the second portion of the stator face during which the magnetic flux, except magnetic flux leakage, does not pass through the rotor face into or out of the stator magnetic flux path;

shape of the rotor face; and

length of the rotor face.

10. An electro-magnetic device as defined in claim 9 wherein the first and second rotor faces are in separate planes which are substantially parallel to each other; and the non-continuous stator magnetic flux path comprises a first path member extending from the second end of the stator face in a plane substantially parallel to the plane of the first rotor face to a second path member extending in a plane substantially perpendicular to the planes of the rotor faces, the second path member, and a third path member extending from the second path member in a plane substantially parallel to the plane of the second rotor face to the first end of the second stator face.

11. An electro-magnetic device as defined in claim 10 wherein each of the first and second rotor faces is configured in an arc in its respective plane; the rotor means rotates around the input/output shaft in a circular path; and each of the first and second stator faces is configured in an arc along at least a part of the circular path of the rotor means.

12. An electro-magnetic device as defined in claim 11 further comprising at least one other similar electro-magnetic device wherein the rotor means of each of the devices is magnetically insulated from the rotor means of

each other device; the rotor means of each of the devices is connected to a common input/output shaft in a balanced configuration and rotates around the shaft in a common circular path such that the rotor means of each device passes between the stator faces of each of the other devices.

13. An electro-magnetic device as defined in claim 9 wherein the first and second rotor faces are spaced apart in a first direction; the first and second rotor faces have curved surfaces which are substantially parallel to each other; and the non-continuous stator magnetic flux path comprises a first path member extending from the second end of the stator face in a plane substantially perpendicular to the surface of the first rotor face to a second path member extending in a direction substantially parallel to the first direction in which the rotor faces are spaced apart, the second path member, and a third path member extending from the second path member in a plane substantially perpendicular to the plane of the second rotor face to the first end of the second stator face.

14. An electro-magnetic device as defined in claim 13 wherein the rotor means moves relative to the stator means around the input/output shaft in a circular path; each of

the first and second rotor faces is positioned at substantially the same distance from the input/output shaft; and the length of each rotor face in the direction of the circular path is less than 360′.

15. An electro-magnetic device as defined in claim 14 wherein the rotor means is connected to and rotates with the input/output shaft and is positioned closer to the input/output shaft than is the stator means.

16. An electro-magnetic device as defined in claim 15 further comprising at least one other similar electro-magnetic device wherein the rotor means of each of the devices is magnetically insulated from the rotor means of each other device; the rotor means of each of the devices is connected to a common input/output shaft in a balanced configuration and rotates around the shaft in a common circular path such that the first and second rotor faces of the rotor means of each device pass by the corresponding stator faces of the stator means of each of the other devices.

17. An electro-magnetic device as defined in claim 14 wherein each of the stator faces has a length in the

direction of the circular path which is less than 360′ and greater than about 240′.

18. An electro-magnetic device as defined in claim 17 wherein the rotor means is connected to and rotates with the input/output shaft and is positioned closer to the input/output shaft than is the stator means.

19. An electro-magnetic device as defined in claim 14 wherein the stator means is connected to and rotates with the input/output shaft and is positioned closer to the input/output shaft than is the rotor means.

20. An electro-magnetic device as defined in claim 17 wherein the stator means is connected to and rotates with the input/output shaft and is positioned closer to the input/output shaft than is the rotor means.

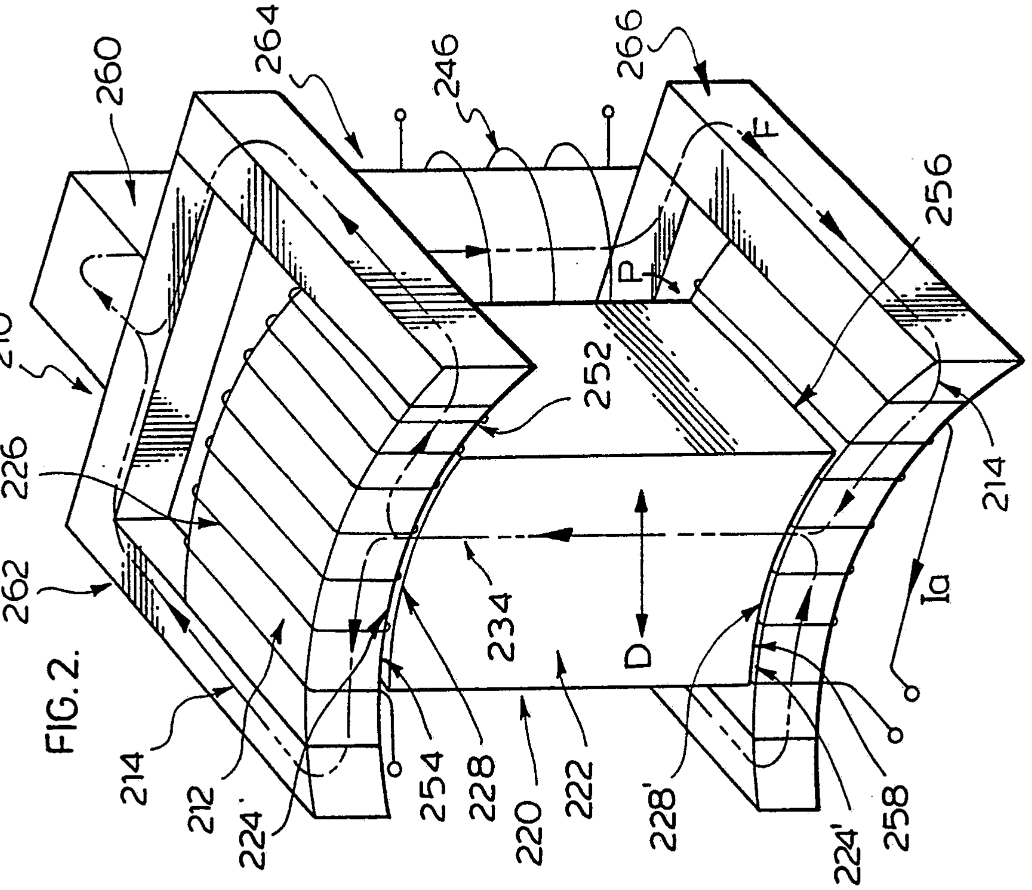

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FIG. 2.

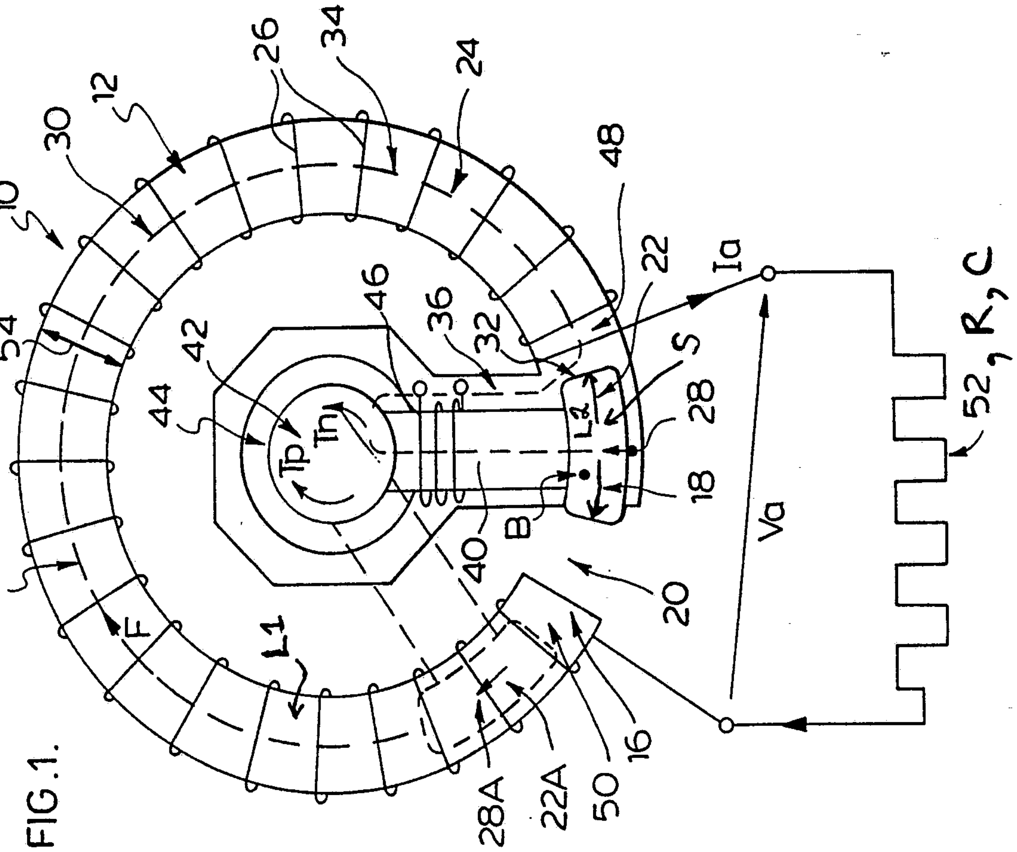

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FIG. 1.

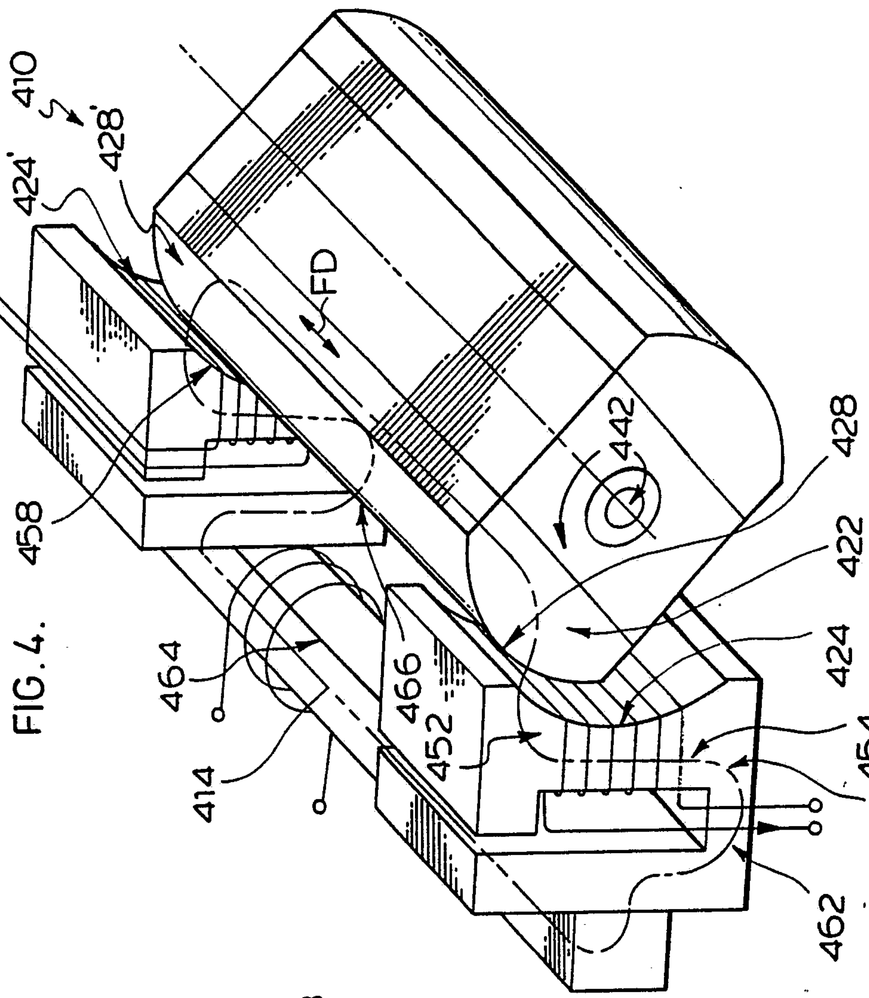
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FIG. 4.

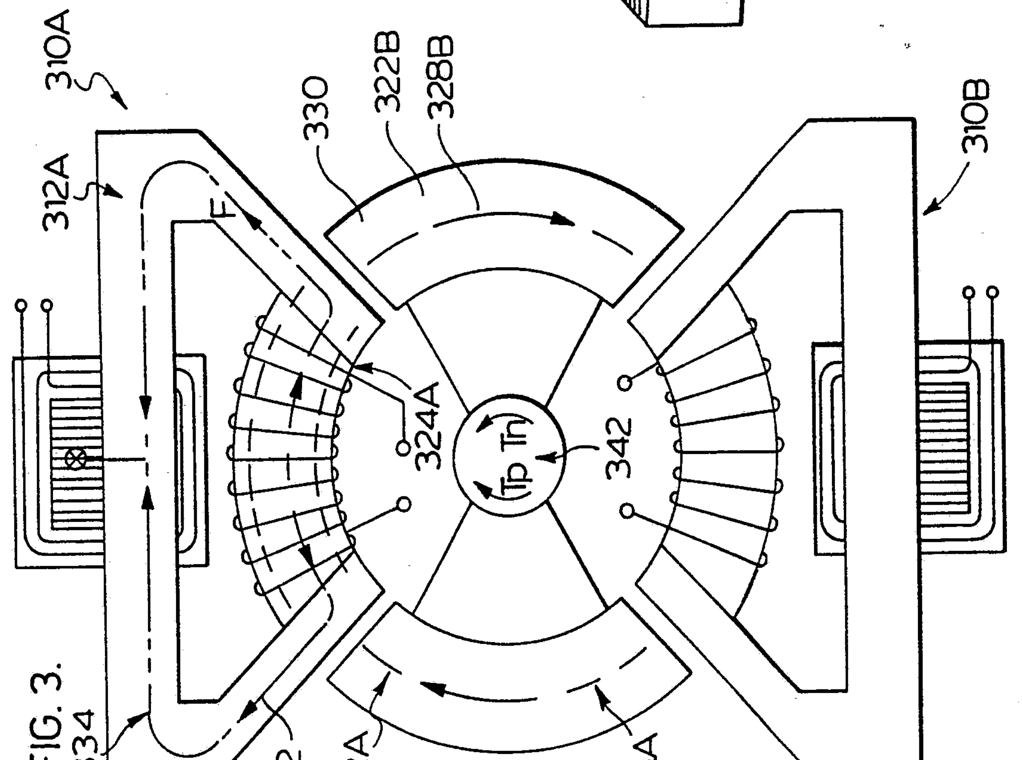
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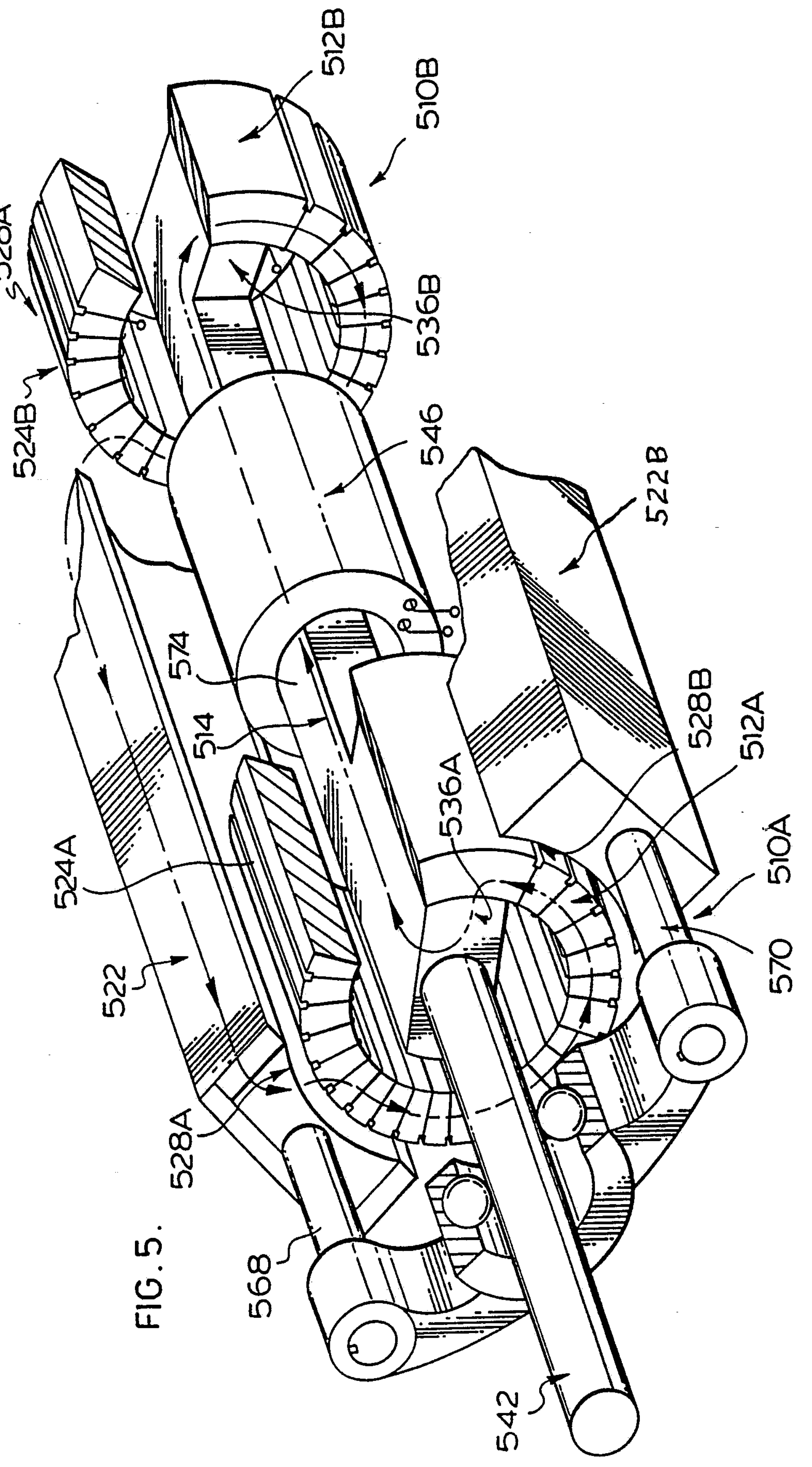
FIG. 3.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568
542

FIG. 5.

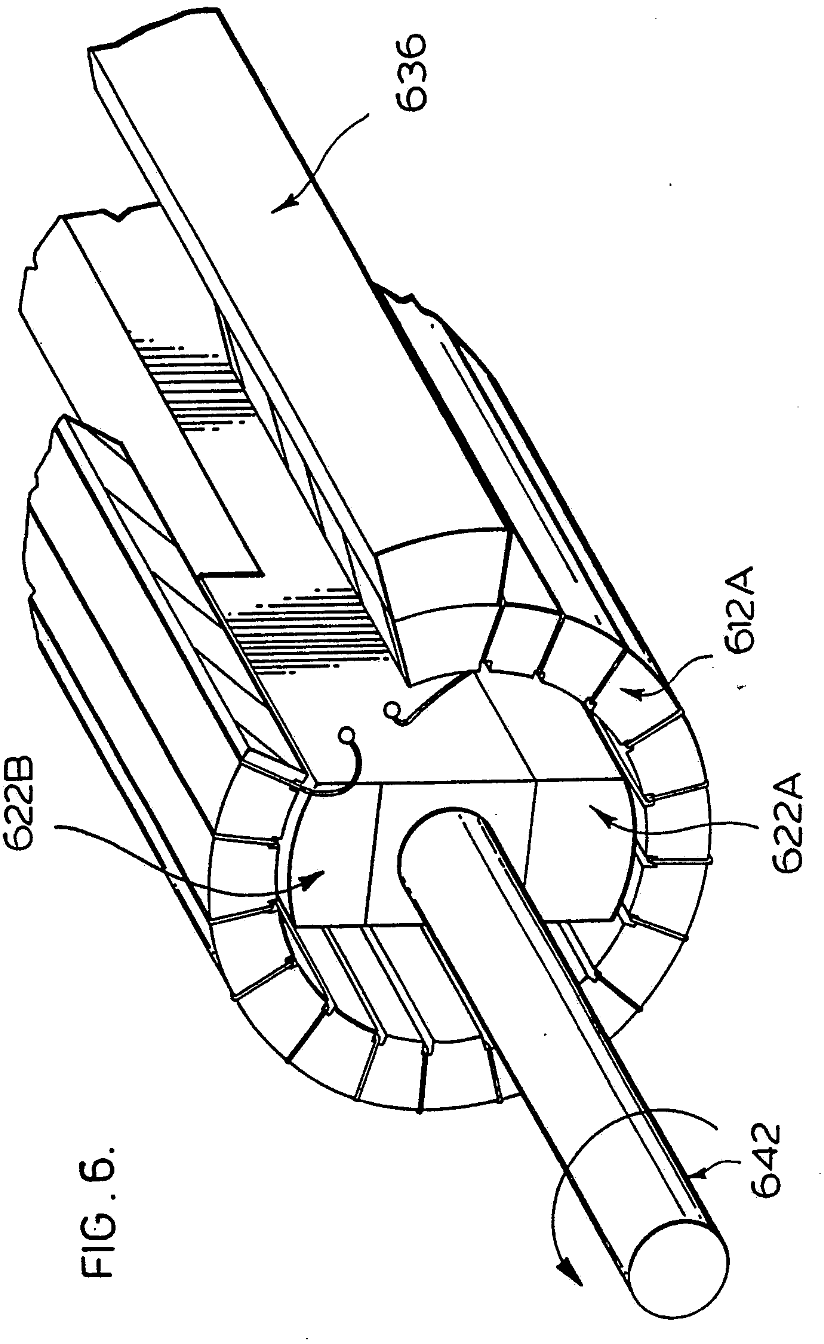

FIG. 6.

INTERNATIONAL SEARCH REPORT

International Application No PCT/CA 93/00088

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5 H02K19/18; H02K19/20

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	H02K

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category°	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X	FR,A,2 603 433 (HINDRE) 4 March 1988	1,2,8, 10, 13-15, 17,18
	see page 2, line 5 - page 4, line 30; figures 1,2	
Y		4,5,7
Y	DE,A,1 935 657 (MÜLLER) 28 January 1971 see page 1, line 1 - page 2, line 14; figure 1	4,5,7
X	FR,A,2 616 980 (HINDRE) 23 December 1988 see page 1, line 24 - page 5, line 15; figures 1,2	1,2,12, 16
Y		6,9

-/--

° Special categories of cited documents :[10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
05 JULY 1993	16.07.93
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	TIO K.H.

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
Y	FR,A,2 279 247 (THOMSON-CSF) 13 February 1976 see page 19 - page 23; figures 1-15	6,9
X	US,A,3 864 588 (INABA) 4 February 1975 see column 4, line 39 - column 6, line 15; figures 1-6	1,3,11
Y		19,20
Y	FR,A,2 632 133 (LEE ET AL) 1 December 1989 see page 7, line 2 - line 10; figure 2	19,20
P,X	US,A,5 130 593 (CONNELL) 14 July 1992 see column 5, line 50 - column 10, line 32; figures 4-6,8,9	1,3,11

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. CA 9300088 SA 72145

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 05/07/93
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
FR-A-2603433	04-03-88	None	
DE-A-1935657	28-01-71	None	
FR-A-2616980	23-12-88	None	
FR-A-2279247	13-02-76	DE-A- 2531472	29-01-76
		GB-A- 1513256	07-06-78
		US-A- 4221983	09-09-80
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		NL-A- 7101346	10-08-71
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US-A-5130593	14-07-92	None	

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82