



# IEA Technology Collaboration Program on High-Temperature Superconductivity (IEA HTS TCP)

## ExCo Meeting In Conjunction with EUCAS

20 September 2017

Geneva, Switzerland



# ExCo Meeting Agenda

1. **Welcome, apologies for absence and agenda approval, (Luciano)**
2. **IEA Update (Luis Munuera)**
3. **Overview of the last ExCo meeting (Yamada/Kinoshita)**
4. **Approval of the minutes of the last ExCo meeting (Brian)**
5. **Financial report: HTS-TCP account status, collected fees and discussion of modified fees (Luciano)**
6. **New Member Engagement (Brian)**
7. **Review OA/ExCo activities (Yamada/Brian)**
8. **Proposed OA/ExCo activities for next fiscal year (All)**
9. **AOB (e.g., agreed Actions List, next steps, ...)**
10. **Date and place of next ExCo meeting(s)**
11. **End of ExCo Meeting**

# 1. Welcome, Apologies for absence and Agenda approval

**Welcome** Luciano Martini, (RSE) IEA HTS TCP Chair

## **Apologies for absence:**

- Sang Chul Han representing Korea
- Debbie Haught representing USA
- Guy Deutscher representing Israel
- Roland Bruniger representing Switzerland
- Gianni Grasso/Matteo Tropeano, Columbus (sponsor)

## **Welcome to:**

- Jean-Maxime Saugrain (Nexans, France) – Observer
- **CERN**
- **China**



## 2. ExCo Meeting Agenda

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## 2. IEA Update

### Presentation from Luis Munuera

# 3. Overview of Japan ExCo

Overview presentation by Yamada

## 4. Approval of the minutes of the Japan ExCo meeting

[Kawasaki ExCo meeting minutes](#)

## 5. Financial report: modified fees

The new fee would potentially go into effect in FY2018

Country/sponsor	GDP (\$T)	Fee
USA	18.6	\$30,000
Japan	4.9	\$30,000
Germany	3.5	\$30,000
France	2.5	\$15,000
Italy	1.85	\$15,000
Canada	1.53	\$15,000
Korea	1.41	\$15,000
Switzerland	0.66	\$15,000
Israel	0.32	\$15,000
Finland	0.24	\$15,000
Sponsors fee	-	\$10,000
		>\$190,000



## 5. Financial report: modified fees

The new fee would potentially go into effect in FY2018

Country/sponsor	GDP (\$T)	Fee	
USA	18.6	\$30,000	30 k
Japan	4.9	\$30,000	50 k
Germany	3.5	\$30,000	30 k
France	2.5	\$15,000	
Italy	1.85	\$15,000	22 k
Canada	1.53	\$15,000	15 k
Korea	1.41	\$15,000	9 k
Switzerland	0.66	\$15,000	10 k
Israel	0.32	\$15,000	9 k
Finland	0.24	\$15,000	8 k
Sponsors fee	-	\$10,000	10 k
		>\$190,000	193 k

## 6. New Member Engagement (Tier 1)

Potential Member	Country/ Organization	ExCo Member to follow-up	Notes
Jean Maxime	Nexans	Luciano	Luis is working to start paperwork
Pascal Tixador	France	Luciano	
	China/ Innopower	Yamada	
Luca Bottura/ Amalia Ballarino/ Lucio Rossi	CERN	Luciano/Bertrand	
Vitalo Visotsky	Russia	Luciano?	Adam Shelton (STI) is sending a another Russian contact
Knut Samdal	Norway	Jean-Maxime/ Luciano	
Dag Willen Asger Bech Abrahamsen	Denmark/nkt cables DTU Wind Energy		
Rob Ross Marc Dhalle Marcel ter Brake	Netherlands	Bertrand knows Marc and can also make a connection to Marcel	

## 6. New Member Engagement (Tier 2)

Potential Member	Country/ Organization	ExCo Member to follow-up	Notes
David Cardwell Harold Ruiz Rondan	UK	Mathias Brian	
Nick Long	New Zealand	Tabea	
Venkat Selvamanickam	UH	Brian/ Luciano	
Richard Taylor	Australia/ Queensland University	Mathias	
Ali Gencer	Turkey	Luciano?	
Alexander Polasek	Brazil	Luciano and Mathias	
Michael Becker	Deutsch-Nano	Mathias	
Xavier Obradors	Spain	Luciano	

# 7. Operating Agent Activities

- **EUCAS Publication**
  - Paper
  - Poster
- **Newsletters**
- **Fact sheets**
- **Annual report**
- **Technical meetings**



# 7. OA Activities – EUCAS Publications

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## Technology Collaboration Program on High-Temperature Superconductivity (HTS): HTS Applications May Influence International Standardization Activity

G. Angeli, B. Marchionini, Y. Yamada, H. Ohsaki, L. Martini

**Abstract** – High-temperature superconductivity (HTS) for electric power systems is the main focus of the HTS Technology Collaboration Program (TCP), an International Energy Agency initiative. Through its nine contracting partners and two sponsors, the HTS TCP fosters the penetration of HTS applications in electric power grids. HTS TCP activities facilitate information exchange among the most important HTS actors worldwide. As a common platform to promote HTS applications, the HTS TCP also paves the way for progress in international standardization. Information exchange within the HTS TCP is often the starting point for developing standards that influence present and future power systems design. Recent activities demonstrate the need toward collaborative activities in standardization; examples include the liaison between the International Electrotechnical Commission's (IEC's) Technical Committee on superconductivity (TC 98) and CIGRE's Project Team 04/05, launched in the framework of the IEC's Technical Committee on electric cables (TC 20); and two round robin tests on MoB.

**Index Terms** – High-Temperature Superconductivity, International Energy Agency, Technology Collaboration Program, Standardization

### I. INTRODUCTION

The International Energy Agency (IEA) actively promotes dissemination and awareness of energy-related issues, covering technical topics such as smart grids, demand side management, and energy efficiency. High-temperature superconductivity (HTS) for electric power systems is the main focus of one IEA initiative, the HTS Technology Collaboration Program (HTS TCP). Through its nine

contracting partners and two sponsors, this group fosters the penetration of HTS applications in electric power grids. The HTS TCP mission is twofold: (1) to evaluate the status and assess the prospects for the electric power sector's use of HTS within the developed and developing world and (2) to disseminate the findings to decision makers in government, the private sector, and the research and development community.

The HTS TCP conducts outreach directed toward the following groups of stakeholders:

- *Electric utilities*, those who make decisions about technology adoption
- *Governments*, those who make decisions about policies, subsidies, and funding for research, development, and demonstration (RD&D)
- *The professional engineering community*, those who implement and advise
- *The RD&D community*, those who invent, innovate, and solve complex problems

These four groups are sources of expertise that can inform the evaluations and assessments performed under the TCP. TCP participants also recognize the importance of educating the next generation of engineers and see this as a key outcome of their information-sharing.

The HTS TCP's singular mission has attracted interest and action from collaborators across the globe. HTS demonstration projects have been successfully carried out in Asia, Europe, and North America, and new projects are under way. This work can lead to better HTS materials, conductors, products, and devices—at a time when the public demands green power and a sustainable environment, leading to changing requirements for the power sector and a need for government-sponsored RD&D that is both impactful and cost-effective.

### II. IEA HTS TCP Activity

#### A. At a Glance

A recent HTS TCP task is the so-called "World Projects at a Glance". TCP participants are gathering information about the main HTS application projects ongoing worldwide and using the information to develop an interactive map that is hosted

## Technology Collaboration Program Zoom in (Ctrl+Plus) Future Superconductivity HTS APPLICATIONS MAY INFLUENCE INTERNATIONAL STANDARDIZATION ACTIVITY

Giuliano Angeli,<sup>1</sup> Brian Marchionini,<sup>2</sup> Yutaka Yamada,<sup>3</sup> Hiroyuki Ohsaki,<sup>4</sup> Luciano Martini<sup>1</sup>

1. IEA-HTS, RSE, Italy, 2. IEA-HTS, Operating Agent, USA, 3. IEA-HTS, SSTC, China, 4. IEA-HTS, University of Tokyo, Japan

31/07/15, Sept. 20

### BACKGROUND AND MOTIVATION

**IEA-HTS-TCP<sup>1</sup>**

Dissemination of HTS technology and industry → accelerating HTS industrialization

Members include:

- Contracting partners
- Sponsors

Mission: To evaluate the status and assess the prospects for future use of HTS by the electric power sector within the developed and developing world and to disseminate these results to decision makers in government, the private sector, and the RD&D community.

The HTS TCP conducts outreach directed toward four groups of stakeholders: Electric utilities, governments, the professional engineering community, and the RD&D community. These four groups are sources of expertise that can inform the evaluations and assessments performed under the TCP.

### HTS-TCP ACTIVITY<sup>1</sup>

#### World Project at a Glance

This interactive and constantly updated map on the HTS TCP website bookends ongoing projects and provides a platform where users can get information and a snapshot of the project, selecting the desired project.

**HTS News Journal**

Seasonally published at website: [www.iea-hts.org](http://www.iea-hts.org)

Hot news and trends in electric power and energy applications of HTS, including HTS wire and cabling systems.

2017 Summer Issue

#### ExCo (Executive Committee) Meeting

Held 2-3 times a year in major cities or at conferences

Discussions include:

- Host country's topics and discussions
- Member country's activity

(Above) The ExCo discussed HTS cable communication and what is needed from now on with HTS industry experts input and member countries.

(Left) Discussion about IEA-TCP cooperation to solve global and common energy issues.

### STANDARDIZATION STATUS<sup>2,3</sup>

The main standardization committee on Superconductivity: IEC TC 98

**Established in 1989**

People involved: 97 from 34 countries

Number of Working Groups (WG): 14

**Product Standards**

IEC 61709-14: 2010

IEC 61709-01: 2014

**TC 98<sup>4</sup> «Superconductivity»**

**WG D1.64<sup>4</sup>**

"Electrical insulation systems of cryogenic transformers"

**SCOPE:** Fundamentals and applications on electrical insulation techniques for superconducting power apparatus and other applications to be operated at cryogenic temperatures.

Start: 2016

Final report: 2019

ExCo meeting supports and accelerates

**WG D1.69<sup>4</sup>**

"Guidelines for test techniques of High Temperature Superconducting systems"

**SCOPE:** To study the existing HTS power installations and compile the relevant data that will assist the power industry to test HTS technology used in the transmission and distribution grid.

Start: 1<sup>st</sup> Quarter 2017

Final report: 2020

**CONCLUSION AND OUTLOOK**

The information exchange within the HTS TCP is often the starting point to develop new standards in funding the present and future power systems design. The IEA-HTS-TCP supports and accelerates the standardization through regular Executive Committee meetings and publications and outreach.

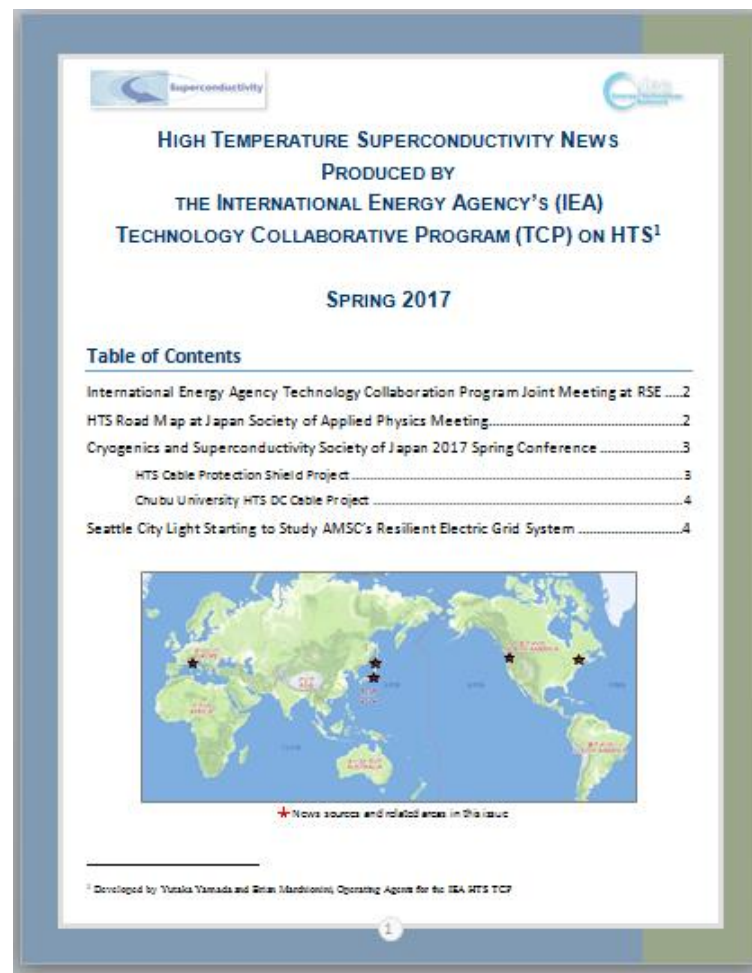
Paper

Poster

# 7. OA Activities - Newsletters



Winter 2017



Spring 2017



# 7. OA Activities - Fact Sheets

## Cables



## FCL



## Policy

### Benefits

Superconductor cable systems can be used to improve T&D substation reliability, serve new load without requiring new substations, achieve lower costs in underground cable construction, and complete any project where minimizing the impact on the environment is important. HTS systems enable

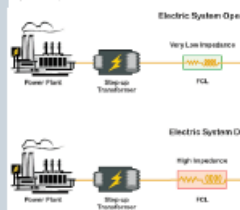
- Transmission of up to 10 times more power than conventional cables with the same cross section, or can carry equivalent power at much lower voltages
- Reduced right-of-way for transmission and distribution corridors
- Elimination of need for soils engineering and construction for thermal management
- Optimal environmental friendliness due to a lack of external electric or magnetic fields
- Fault current management capability, creating a more interconnected, resilient and reliable grid

### What are the benefits of FCLs to utilities?

- Enhanced system safety, stability, and efficiency of the power delivery systems
- Reduced or eliminated wide-area blackouts, reduced localized disruptions, and reduced recovery time when disruptions do occur
- Reduced maintenance costs by protecting expensive downstream T&D system equipment from constant electrical surges that degrade equipment and require costly replacement
- Improved system reliability when renewables and DG are added to the electric grid
- Elimination of split buses and opening bus-tie breakers
- Reduced voltage dips caused by high resistive system components
- Increased short circuit handling capacity of existing grids without having the need to upgrade existing equipment

### What are Fault Current Limiters

A fault is an unintentional short circuit, or system. A variety of factors such as light power lines cause faults. During a fault, a current—flows through the electrical system resulting in temporary loss of capacity to serve load. A fault current limiter flowing through the system and allows operation of the electrical system. Current technologies exist: high-temperature superconducting (HTS).



### Why do we need Fault Current Limiters

The need for FCLs is driven by rising system demand increases and more distributed such as wind and solar, are added to non network.

Technology	
Explosive fault-limiting fuses	• Available today
Series reactors	• Service call rec
Solid state fault current limiters	• Used routinely
Superconducting FCLs	• Consume react
	• Electronic cont downstream pr
	• No impedance



## High Temperature Superconductivity - Enabling Innovation in the 21st Century

### HTS Benefits

The changes affecting the electric power sector offer an unprecedented opportunity to transform the future grid. Increasing needs for flexibility, reliability, and resilience in the transmission and distribution (T&D) system require technologies and techniques not conceived of when much of the current infrastructure was deployed. During this period of transition, the deployment of new technologies will play a critical role in shaping the future grid. High temperature superconductors are potentially key in the suite of technologies that can help facilitate grid modernization, reduce losses and hence CO<sub>2</sub> emissions and increase energy security.

For the global power sector, the International Energy Agency (IEA) estimates that \$16.4 trillion of investment will be made; transmission and distribution is expected to account for \$7 trillion under their New Policies Scenario from 2014–2035. (In 2012US\$). The Edison Electric Institute estimated that the total infrastructure investment in the United States will be between \$1.5 trillion and \$2.0 trillion; transmission and distribution is expected to account for about \$900 billion by 2030.<sup>1</sup>

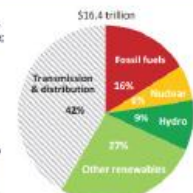
The changes affecting the electric power sector offer an unprecedented opportunity to transform the future grid. Increasing needs for flexibility, reliability, and resilience in the transmission and distribution (T&D) system require technologies and techniques not conceived of when much of the current infrastructure was deployed. During this period of transition, the deployment of new technologies with higher-performance components, such as high temperature superconducting based devices, will play a critical role in shaping the future grid.

### Background on HTS

Superconductivity is a phenomenon that causes certain materials, at extremely low temperatures, to lose all resistance to the flow of electricity. The lack of resistance enables a range of innovative technology applications.

Devices based on superconductivity have been available in certain niche markets for decades. In particular, superconducting magnets are used in many applications requiring powerful electromagnets, such as in magnetic resonance imaging (MRI) machines. Superconductivity has broad applications, including the energy, transportation, industry, medical, and defense sectors.

High temperature superconducting (HTS) wire is the key enabler of making devices for the electric power system that are more efficient and resilient than conventional solutions.

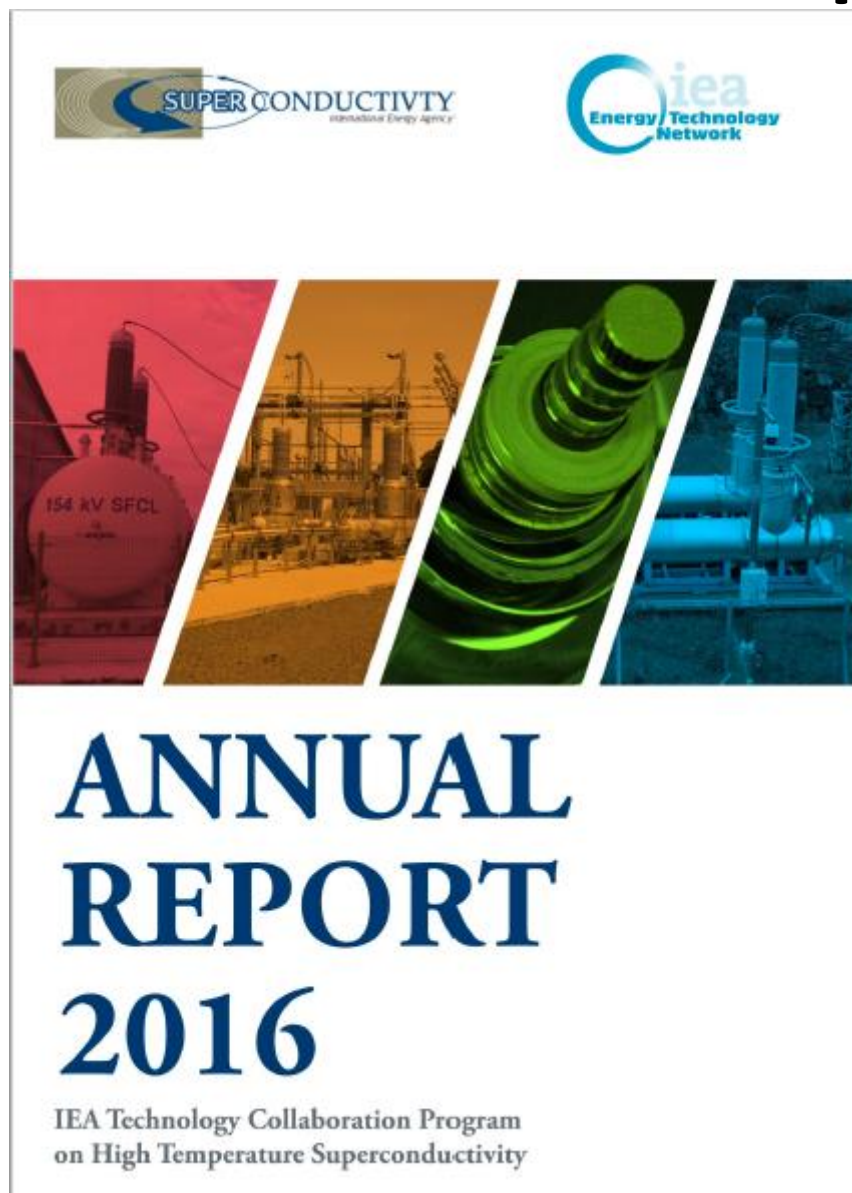


\$16.4 trillion of investment is expected globally for energy investments, 42% of this is expected for T&D infrastructure for 2014-2035.



The ultra thin wires carry the equivalent power as the large diameter copper wires. Courtesy AMSC.

## 7. OA Activities - Annual Report



[2016 Report](#)



# 7. OA Activities - Technical Meetings

China update from Yamada

## 7. OA Activities - Technical Meetings

- **European Cryogenics Days 2017 and the 2<sup>nd</sup> International Workshop on Cooling Systems for HTS Applications, Sep 13-15**
- **First International conference on Cryogenics held Oct 2015 in Japan**
- **132 people at 2017 conference**
  - Cryogenics in Astrophysics, Particle Physics and Computing, Cryogenics in Transportation, Air Separation and Power Applications, Power Grid Applications, Novel Machinery, Small-scale Applications (SQUIDS, etc)
  - Technical Excursion to Karlsruhe Tritium Neutrino Experiment KATRIN and HTS lab

## 8. Proposed OA Activities for 2018

Task	Due Date	Status	Lead	EI	Yamada
Update website with new info Link to superconductivity news forum and need to update SNF with our latest website					
Fact sheet on rotating machines					
Fall HTS newsletter			Yamada		
Develop mailing list to distribute newsletter					
Develop new graphics – transmission right of way					
Identify conferences to attend and get on agenda to present					
Define appropriate person in China to join TCP in 2018			Yamada		
Update spreadsheet of projects			Yamada		
Develop abstract idea for ASC					
Logo rebranding			Brian/Anna		
Send password to restricted section to Luciano/Yamada			Brian		

## 9. AOB

Task	Due Date	Status	Lead
Email Selva about proposed dates + Send Doodle to ExCo to set next two mtg dates (April 4-6, April 9-11) 2.5 day mtg max and fall meeting at ASC (0.5-1 day meeting on Sat or Sun)	ASAP		Brian
Send msg to Luis to follow-up on status of France (letters, communication) (thank you for your presentation; we have comments; + membership of France ASAP)	ASAP		Brian
Follow-up with IEA contact for France incorporation	ASAP + 1 week		Brian/Luciano
Ask IEA what appropriate procedure is for engaging non OECD countries	2 weeks		Brian/Luciano
Circulate meeting minutes to ExCo members (send only to exco members that attended the meeting.	1 week		Brian/Anna
Send final draft minutes to all exco members and observers	1 month		Brian/Anna
Update FCL, Cable and Policy fact sheet	2 weeks		Brian/Anna
Wire update-place, material, tech characteristics	1.5 months		Yamada
Update website (world projects at a glance) with new info from EUCAS	1.5 months		
Preliminary Draft of Annual Report 2017 available to ExCo members	8 Dec		Brian/Anna
Explore and nurture relationship with CERN and NL. Keep			Bertrand



# 10. Date and Place of Next ExCo

- **March/April 2018**
  - We need to agree on two dates and give them to Selva for confirmation
- **Houston, TX**
  
- **Oct/Nov 2018**
  - **ASC 2018 – Oct 28 – Nov 2**
  - **Lausanne, Switzerland (TBC)**

# Other Discussion Points

## ■ TCP Meeting

- 2nd Universal Meeting of IEA Technology Collaboration Programmes - Strategy Meeting to Further Strengthen Collaborative Energy Innovation
- Monday, 9 October 2017 (09h30 – 17h45)
- 16 rue Jean Rey – 75015 Paris, France

## ■ ASC 2018 – Oct 28 – Nov 2

- Abstract Submission Opens - January 15
- Abstract Submission Deadline - March 21
- Interaction with organizers on special session

# Strategy Session

- **What should the ExCo be doing in the next 6-12 months to increase effectiveness and expand its reach?**
- **Strengths, Weaknesses, Opportunities, Threats analysis**

# SWOT

<p><u>Strengths</u></p> <ul style="list-style-type: none"><li>• IEA Support/backing</li><li>• Active members are leaders in the HTS application field</li></ul>	<p><u>Weaknesses</u></p> <ul style="list-style-type: none"><li>• Not all members are active</li><li>• Members have very little time to devote to ExCo activities</li><li>• Website “hits” are very low</li></ul>
<p><u>Opportunities</u></p> <ul style="list-style-type: none"><li>• New countries seem interested (FR, NZ)</li><li>• Countries with HTS activity (China, RU)</li></ul>	<p><u>Threats</u></p> <ul style="list-style-type: none"><li>• Reduced interest by govt/industry leading to less funding</li></ul>



# 5. Financial Statement Account (first half 2017)

DATE	REVENUES	EXPENSES/ BANK FEES	BALANCE	USD	
01/01/17			149,775.13	balance december 31st 2016	
02/13/17		40.61	149,734.52	bank fees	
02/15/17	11,262.21		160,996.73	money transfer by PARTNER	BRUKER FY16
03/02/17		23,831.77	137,164.96	payment to ENERGETICS	
03/02/17		65.89	137,099.07	bank fees	
03/15/17	14,029.73		151,128.80	money transfer by PARTNER	SIEMENS FY16
03/15/17		46.64	151,082.16	bank fees	
03/24/17	27,780.86		178,863.02	money transfer by PARTNER	JAPAN FY17
04/10/17		87.43	178,775.59	bank fees	
04/28/17	8,657.30		187,432.89	money transfer by PARTNER	ISRAEL FY17
04/28/17		34.93	187,397.96	bank fees	
05/16/17	8,995.00		196,392.96	money transfer by PARTNER	SWITZERLAND FY17
05/16/17		19.61	196,373.35	bank fees	
05/19/17	7,498.00		203,871.35	money transfer by PARTNER	FINLAND FY17
05/22/17	13,766.00		217,637.35	money transfer by PARTNER	GERMANY ITP KIT FY17
05/25/17	-	33,466.30	184,171.05	money transfer to JAP GREEN ENERGY	
05/30/17	19,892.00	-	204,063.05	money transfer by PARTNER	ITALY RSE FY17
05/31/17	13,766.00	-	217,829.05	money transfer by PARTNER	GERMANY SIEMENS FY17
07/10/17		25.00	217,804.05	taxes	
07/10/17	-	66.59	217,737.46	bank fees	
09/06/17	-	8,354.67	209,382.79	payment to ENERGETICS	
09/12/17	7,719.78	-	217,102.57		KOREA FY17

## 5. Financial Statement Account: fees update (**first half 2017**)

<b>PARTNER</b>	<b>USD</b>	<b>EUR</b>	<b>Payement date</b>	<b>Invoice date</b>
JAPAN	30,025.00	27,780.86	28/03/2017	08/03/2017
ITALY RSE	21,675.00	19,892.00	30/05/2017	04/05/2017
SWITZERLAND	9,801.00	8,995.00	16/05/2017	04/05/2017
CANADA	15,025.00			04/05/2017
GERMANY ITP KIT	15,000.00	13,766.00	22/05/2017	04/05/2017
FINLAND	8,170.00	7,498.00	19/05/2017	04/05/2017
ITALY COLUMBUS	12,000.00	11,013.00		04/05/2017
GERMANY SIEMENS	15,000.00	13,766.00	31/05/2017	04/05/2017
ISRAEL	9,500.00	8,657.30	03/05/2017	21/02/2017
KOREA	9,385.00	7,719.78	12/09/2017	04/05/2017
USA	30,025.00			08/05/2017