



ICG TC9 meeting 15th October 2015,
Eindhoven, The Netherlands

Participants meeting

1. Sven-Roger Kahl
2. Diego Ochoa Escalona
3. Emre Dumankaya
4. Alfeo Caputo
5. Erik Muisenberg
6. Gustav Huuskes
7. Oscar Verheijen
8. Hiroyuki Itazu
9. Toru Hasegawa
10. Mark Pudner
11. Bernhard Fleischmann
12. Johannes Vetter
13. Bruno Pernod
14. Shinya Azuma
15. Hans van Limpt
16. Richard hulme

Apologies:

Herve Charles
Valli Murthy
Simone Tiozzo
Christian Roos
Noriyuki Yoshida
Francois Deblock

Allocation of roles



- Chair - Hans van Limpt (CelSian → Sibelco)
- Vice-chair - Wolfgang Schmidbauer (Schott)
- Secretary - Richard Hulme (Guardian)
- Webmaster - Diego Ochoa (Vidrala)

[http://www.icglass.org/technical_committees/?id=30&committee=TC09: Energy Efficiency](http://www.icglass.org/technical_committees/?id=30&committee=TC09: Energy_Efficiency)

2. Members

Glass producers	R&D	Forming / annealing / furnaces/ maintenance	Suppliers to glass industry
Philips (2013/2014)	HVG (2013/2014)	BDF (2013)	Praxair (2014)
Guardian (2013/2014)	SSV (2013/2014)	AGMS (2013)	Air-Liquide (2014)
Vidrala (2013)	British Glass (2013/2014)		Sibelco (2015)
Schott (2013/2014)	CelSian (2013/2014)		
Sisecam (2013/2014)	<i>Glass Service (2015)</i>		
Vidrala (2013/2014)			
IPGR (2014)			
Libbey (2014)			
Bormioli Luigi (2014)			
NSG (2014)			
NEG (2014)			
Ardagh (2014)			

Meetings



- 28-11-2013 : Eindhoven, NL
- 30-5-2014 : Aachen, GER
- 24-9-2014 : Parma, I
- 20-4-2015 : Bilbao, SP
- 15-10-2015 : Eindhoven, NL

Agenda



1. Welcome.
2. Introduction of all participants.
3. Adoption of agenda
4. Discussion minutes 20-4-2015 (Richard Hulme).
5. ICG topics:
 - a. ICG CTC meeting Bangkok Parma 20th September 2015.
 - b. ICG Financial Support (feedback from CTC, Bangkok - Richard, Hans).
6. TC09 website – current status and proposals (Diego Ochoa).
7. General scope of TC09 – **fixed agenda points**:
 - a. Regulations on energy and energy savings.
 - i. Summary of developments in European regulations (Mark Pudner).
 - ii. BREF revisions update (Simone Tiozzo).
 - iii. Regulations in other countries (contributions from attendees welcome).
 - b. Energy Metrics & Methods (Bernhard, Richard, Hans).**
 - c. European Energy Efficiency Directive (EED).
 - d. Energy efficiency roadmaps.
8. *Other TC09 activities*:
 - a. Sharing of practical experiences (it is kindly requested that each company represented prepares a short (10 - 15 minutes) to provide an overview of what they know / want to know about energy use in their process.**
 - b. Selection of appropriate technologies to improve the energy efficiency.
 - c. Identification major process steps for energy improvement.
 - d. Testing & development, evaluation tools.
9. TC09 Future Work Outlook.
10. Society of Glass Technology; Furnace Solutions & Training Days, 2016.
11. Any other business.
12. Next meeting.

Modified agenda: part A



1. Welcome.
2. Introduction of all participants.
3. Adoption of agenda.
4. Discussion minutes 20-4-2015 (Richard Hulme).
5. *Other TC09 activities:*
 - a) **Sharing of practical experiences (it is kindly requested that each company represented prepares a short (10 - 15 minutes) to provide an overview of what they know / want to know about energy use in their process.**
6. ICG topics:
 - a) ICG CTC meeting Bangkok Parma 20th September 2015.
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Modified agenda – part B



7. TC09 website – current status and proposals (Diego Ochoa).
8. General scope of TC09 – ***fixed agenda points***:
 - a) Regulations on energy and energy savings.
 - i. Summary of developments in European regulations (Mark Pudner).
 - ii. BREF revisions update (Simone Tiozzo).
 - iii. Regulations in other countries (contributions from attendees welcome).
 - b) Energy Metrics & Methods (Bernhard, Richard, Hans).**
 - c) European Energy Efficiency Directive (EED).
 - d) Energy efficiency roadmaps.
9. TC09 Future Work Outlook.
10. Society of Glass Technology; Furnace Solutions & Training Days, 2016.
11. Any other business.
12. Next meeting.

4. Minutes of Parma meeting



- To be added

6. ICG Topics



- ❑ ICG CTC meeting Bangkok Parma 20th September 2015.
- ❑ ICG Financial Support (feedback from CTC, Bangkok - Richard, Hans).

7b. Energy Metrics & Methods

(Bernhard, Richard, Hans, Oscar)



- For TC09 as well as the whole glass community it is important to use internationally accepted definitions of energy usage and energy efficiency.

- **At the moment different definitions and methods are applied to compare the energy efficiency of glass installations.**

CelSian applies a web-based benchmark tool to compare energy consumption of glass furnaces. **Oscar Verheijen** will check which 'benchmark' information can be shared with TC09.

- **With respect to the topic 'Energy definitions & benchmarking' the following actions are considered as**

- An internal TC09 benchmark will be initiated, preferably supported financially by ICG.
- For glass furnaces ‘typical’ key parameters will be derived, e.g.: specific wall losses, regenerator efficiency and operating temperatures.
- This specific data will be used to calculate the energy balance of a virtual glass furnace. Finally, energy balances will be used to explain the results of energy efficiency benchmarking.
- Within TC09 a working group will be formed that will focus on the explanation of the energy balance of a demo glass furnace. This demo furnace will be a float furnace. The working group exists of:
 - **Sven Kahl (Ardagh)**
 - **Christian Roos (IPGR)**
 - **Oscar Verheijen (CelSian)**
 - **Richard Hulme (Guardian)**
 - **Emre Dumankaya (Sisecam)**
 - **Hans van Limpt (Sibelco).**

7b. Definitions & standardization



Main question: how to compare energy efficiency of glass melting furnaces?

1. Specific energy per tonne molten glass ?
2. Higher or lower calorific value ?
3. Primary or actual energy consumption ?
4. Normalization (cullet, age, pull...)?
5. Sector wise comparison ?
6. Comparison of efficiency?

Definitions for Benchmarking



Definitions:

- Reference temperature for 'normal conditions' is 0 °C and reference pressure is 101325 Pa.
- In this study, SI (metric) units are used: 1000 kg of material = 1 (metric) tonne
- For the fossil fuel energy contents, the net (lower) calorific (heating) value is used.

- Primary energy equivalent:

In the energy benchmark ranking, the energy consumption is presented as 'primary' energy. This means that the efficiency of an average electric power plant ($\approx 40\%$) is taken into account. This means that:

- **Electricity:** 1 kWh = 9 MJ primary energy
- **Oxygen:** 1 m_n³ (100% O₂) = equivalent to 3.6 MJ primary energy

Cullet normalization – statistically derived from benchmark data



- Container glass – 50% cullet:

$$E_{50} = \frac{E}{-0.0034 * S + 1.17}$$

- Float glass – 25% cullet:

$$E_{25} = \frac{E}{-0.0032 * S + 1.08}$$

Existing methods & definitions



Many discussion points will remain:

- Cullet normalization is a penalty for those who invest in the use of recycling cullet.
- I need boosting for my glass quality and a correction to primary energy is not acceptable.
- Because of the high glass quality I cannot increase the specific pull rate.
- One should calculate the energy per tonne glass sold.
- But our furnace is much smaller ...
- The low energy consumption in the glass furnace results in a high energy consumption of the forehearths.
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