THERMAL INSULATING COATING SYSTEMS

C-COAT Research Cooperation Activities

Universities, Institutes , Energy Association

and

Australian Government

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TUNRA

THE UNIVERSITY OF NEWCASTLE RESEARCH ASSOCIATES

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STATE OF THE ART FACILITIES

The extensive theoretical and experimental study of the thermal performance of housing systems (see Figure 1) in a typical moderate Australian climate has been undertaken from 2001 in the Priority Research Centre for Frontier Energy and Technologies and has involved the major collaboration with various domestic, and international research institutions and industrial partners.

Figure 1: Housing Test Modules

The parallel aspect consisted of the development of a unique purpose built dynamic thermal facility followed by an extensive series of steady-state and dynamic tests on individual walling systems and their components as in Figure 2. This provided the data for defining the key parameters of the thermal performance of each individual wall as well as its components.

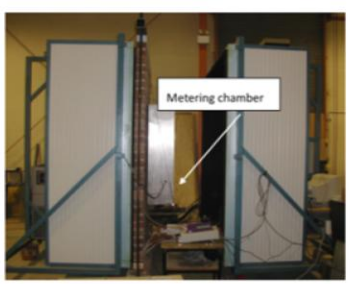

Figure 2: Guarded Hot Box Apparatus

This dynamic thermal apparatus incorporates an external temperature-controlled surround to eliminate any effects of the varying laboratory ambient temperature. The apparatus, as well as being capable of providing a steady-state controlled temperature environment for thermal/heat resistance tests according to Australian (AS/NZS4859.1) and ASTM Standards (ASTM C1363-11 (2)), is also capable of providing a dynamic input temperature cycle to mimic the various Australian daily and seasonal temperature cycles for 2.4 x 2.4 m walls. The apparatus incorporates specialised instrumentation for temperature control, temperature and power consumption measurement, with the recirculating heating units in one of the chambers able to simulate a dynamic cycle. The unit is capable of producing any dynamic temperature profile within the range -10°C and 80°C with up to 1000-time steps. An additional smaller hot-box apparatus is also available to allow a series of common walling systems (1.2 x 1.2m) to be tested under dynamic temperature conditions.

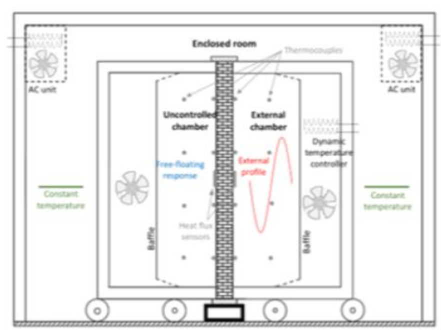

Figure 3: Schematic arrangement of the apparatus for dynamic tests

The chamber to simulate the indoor response of various materials under dynamic temperature changes in macroscale was also designed as in Figure 4. The appartus consists of the external and internal chambers. The external chamber is heavily insulated to avoid the influence of the outside ambient environment on the test results. The air temperature inside the external insulated chamber can be controlled to mimic dynamic temperature conditions using an external heat-exchange unit.


Figure 4: Macroscale chamber

METHODOLOGY OF TESTS

The testing setup, as in Figure 5, will be used for the comparison study of the heat losses for C-coat and classic insulation. Water with various temperature ranges will be pumped via a copper pipe installed in the steady-state environment of the chamber. The temperature difference between inlet and outlet will be measured to assess the heat losses in the hot water circulation.

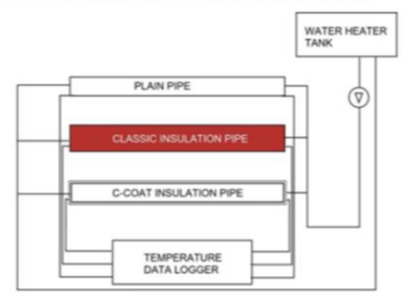

Figure 5: Testing setup

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Study classes

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Iroda

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4011 Debrecen, Pf.: 40.

MINUTES OF MATERIAL INSPECTION

Based on the contract filed under # TMK/427/2010 (2010.03.19), the measurements necessary for defining the relevant heat conductivity factor regarding the subject coating with conducting capacities produced by the SZTK Scientific Centre of the Russian Federation has been carried out in the Building Physics Laboratory of the Debrecen University – Technical Branch.

The Building Physics Laboratory of the Debrecen University – Technical Branch provides the opportunity for defining the heat transmission factor of masonries on the basis of relevant measurements.

The inspections were carried out based on the following standards requirements: MSZ EN 1934:2000 „Heat-technical behaviour of buildings: definition of the heat-transmission resistance by the method of measuring chamber with heat-flow meter. Masonry" and the standard of MSZ EN ISO 8990:2000 „Heat insulation: definition of the heat-transmission characteristics in a fixed state. Calibrated chamber and auxiliary chamber (ISO 8990:1994)" requirements were also taken into consideration. The arrangement of the spaces needed for the measurements is shown in figure 1.

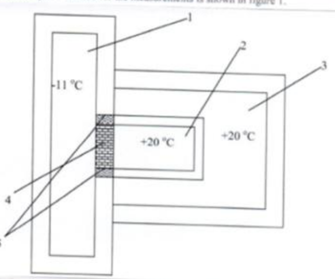

Figure 1: Spaces necessary for the measurement and their temperatures (auxiliary chamber process) 1 – cold space; 2 – measuring chamber; 3 – auxiliary chamber; 4 – trial masonry; 5 – polystyrene heat insulation suitable for excluding heat flows other than vertical to the trial masonry.

The translation has been made from Hungarian into English language and it corresponds to the original Hungarian text in everything.

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In the last line of the chart was the specific heat-flow calculated for two days as well as the value of the average surface temperature difference. From these values can the resistance of the heat insulated structure be calculated, which in the subject case was given to be **2.496 m^2 K/W**. Therefore, the 2 mm thick heat insulating layer caused an increase of 1.126 m^2 K/W in resistance.

The heat-transmission resistance of the heat insulated wall, which also considers the heat-transmission factors:

R_o=2,664 m^2 K/W. Therefore the heat-transmission factor is **U=0.375 W/m^2 K.**

Considering the applied layer thickness to be of 2 mm, the heat-transmission factor of the unknown material is given to be of 0.00177 W/mK.

The following chart shows what effect the application of the material as post-heat insulation will have in case of an ordinary structure.

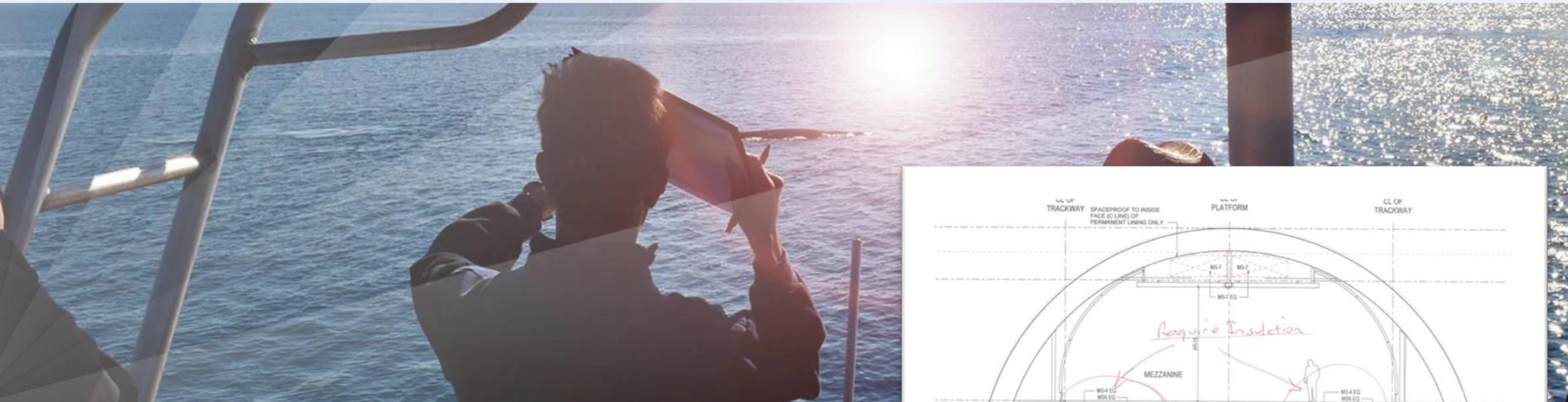
	d	lambda	R	heat-transm. res.	Rő	U
B30	0,02	0,81	0,024691			
	0,3	0,64	0,46875			
	0,02	0,93	0,021505	0,514946734	**0,682947**	**1,464243**
hőszigetelés	**0,003**	**0,00177**	**1,694915**		**2,377862**	**0,420546**
t. tégla	0,02	0,81	0,024691			
	0,38	0,78	0,487179			
	0,02	0,93	0,021505	0,533376222	**0,701376**	**1,425768**
hőszigetelés	**0,003**	**0,00177**	**1,694915**		**2,396291**	**0,417312**
t. tégla	0,02	0,81	0,024691			
	0,5	0,78	0,641026			
	0,02	0,93	0,021505	0,687222375	**0,855222**	**1,169287**
hőszigetelés	**0,003**	**0,00177**	**1,694915**		**2,550138**	**0,392136**
panel	0,02	0,81	0,024691			
	0,15	1,55	0,096774			
	0,08	0,057	1,403509			
	0,05	1,55	0,032258	1,557232388	**1,725232**	**0,579632**
hőszigetelés	**0,002**	**0,00177**	**1,129944**		**2,855176**	**0,350241**

hőszigetelés – heat insulation
t.tégla –brick
panel –panel

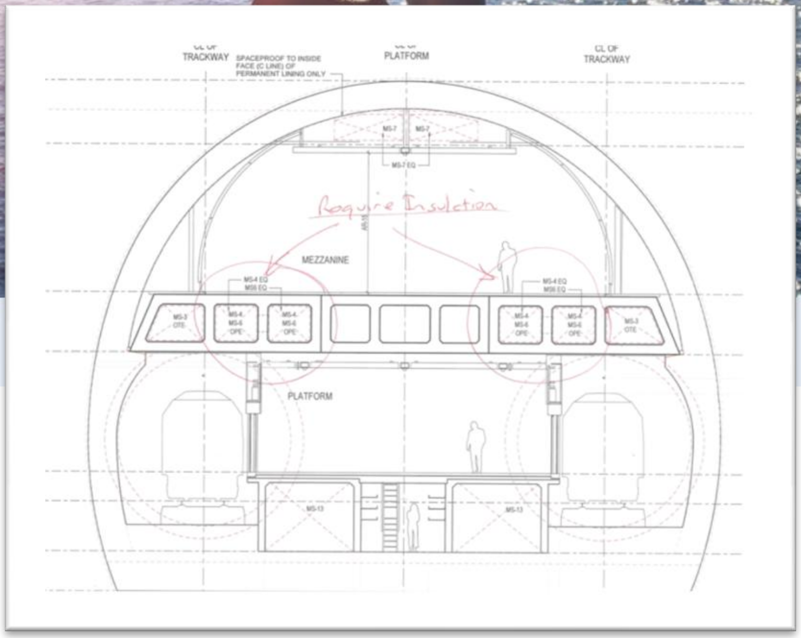
Dated: Debrecen, 2nd April 2010

Dr. Ferenc Kalmár
Academic

Imre Csáki
Assistant



Research



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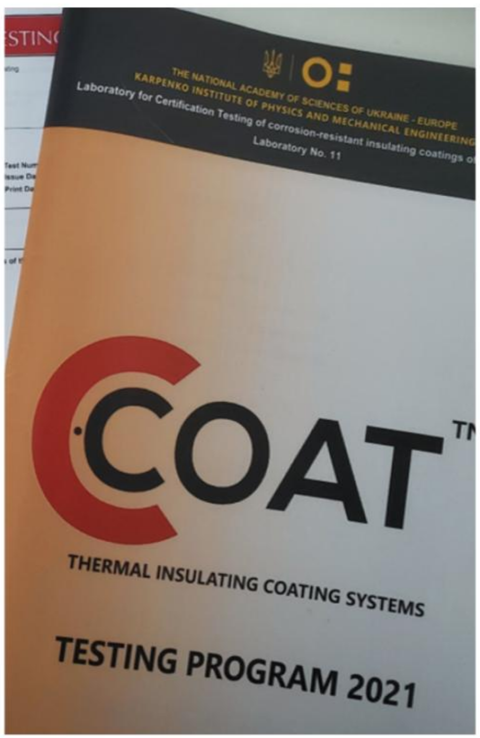
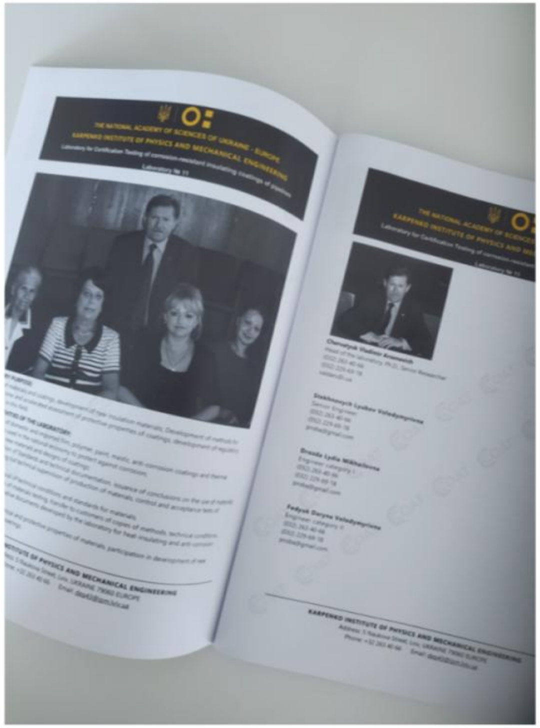
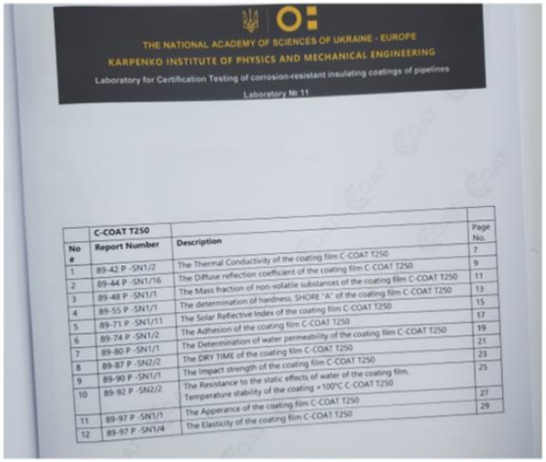
KARPENKO INSTITUTE OF PHYSICS AND MECHANICAL ENGINEERING

Laboratory for Certification Testing of corrosion-resistant insulating coatings of pipelines

Laboratory No. 11







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No #	C-COAT T250 Report Number	Description	Page No.
1	89-42 P -SN1/2	The Thermal Conductivity of the coating film C-COAT T250	7
2	89-44 P -SN1/16	The Diffuse reflection coefficient of the coating film C-COAT T250	9
3	89-48 P -SN1/1	The Mass fraction of non-volatile substances of the coating film C-COAT T250	11
4	89-55 P -SN1/1	The determination of hardness, SHORE "A" of the coating film C-COAT T250	13
5	89-71 P -SN1/11	The Solar Reflective Index of the coating film C-COAT T250	15
6	89-74 P -SN1/2	The Adhesion of the coating film C-COAT T250	17
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11	89-97 P -SN1/1	The Apperance of the coating film C-COAT T250	27
12	89-97 P -SN1/4	The Elasticity of the coating film C-COAT T250	29

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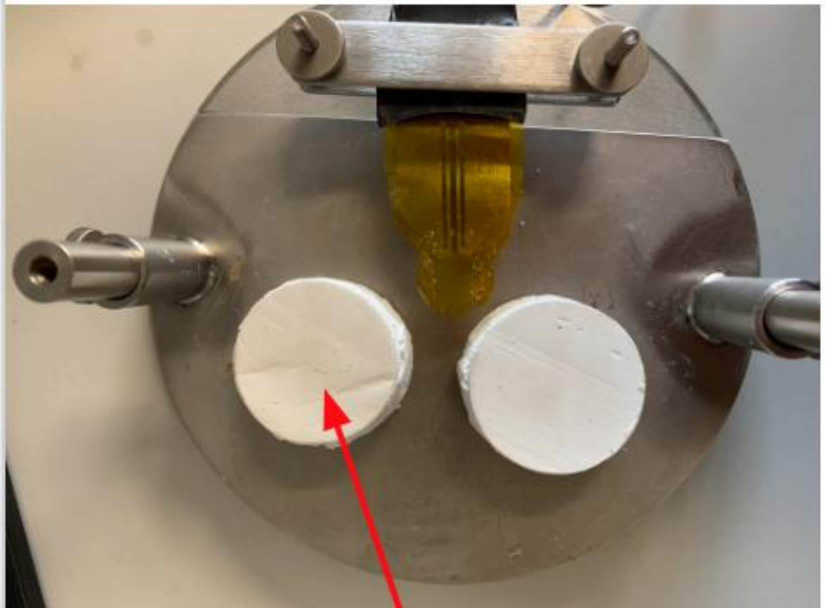
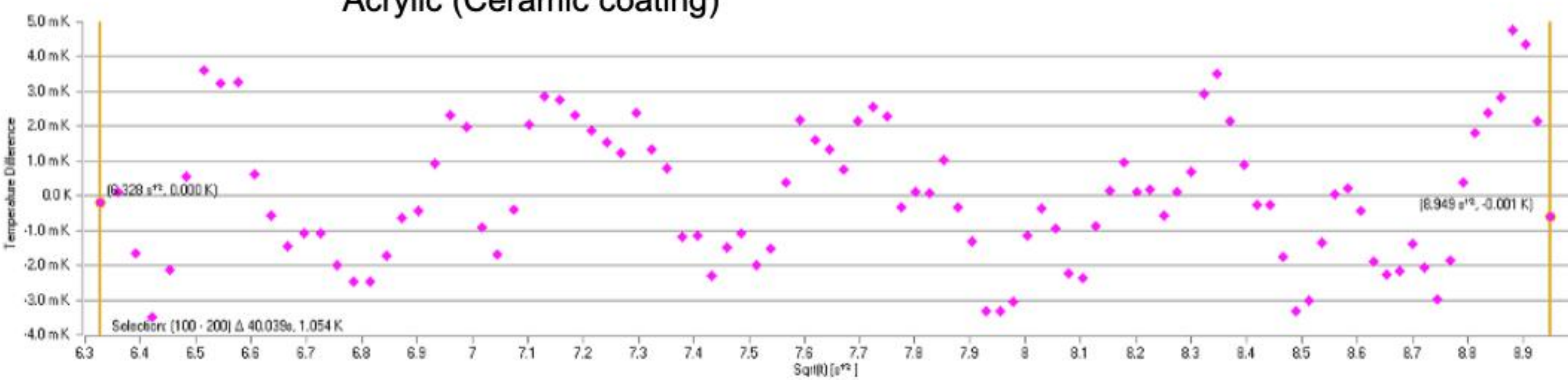


Thermal Power range: 50 - 70 mW
Measuring time: 80 - 160s

Acrylic (Ceramic coating)



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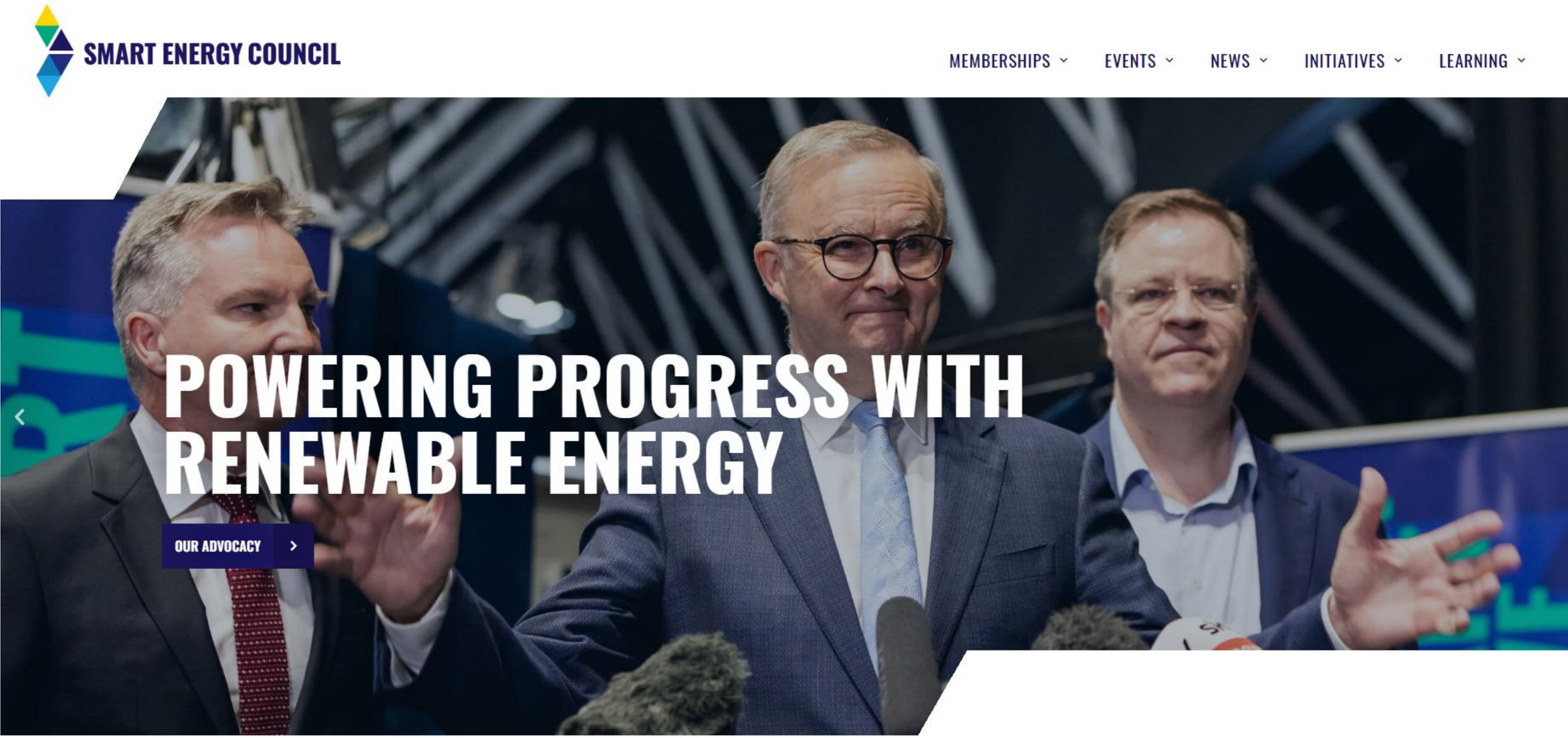

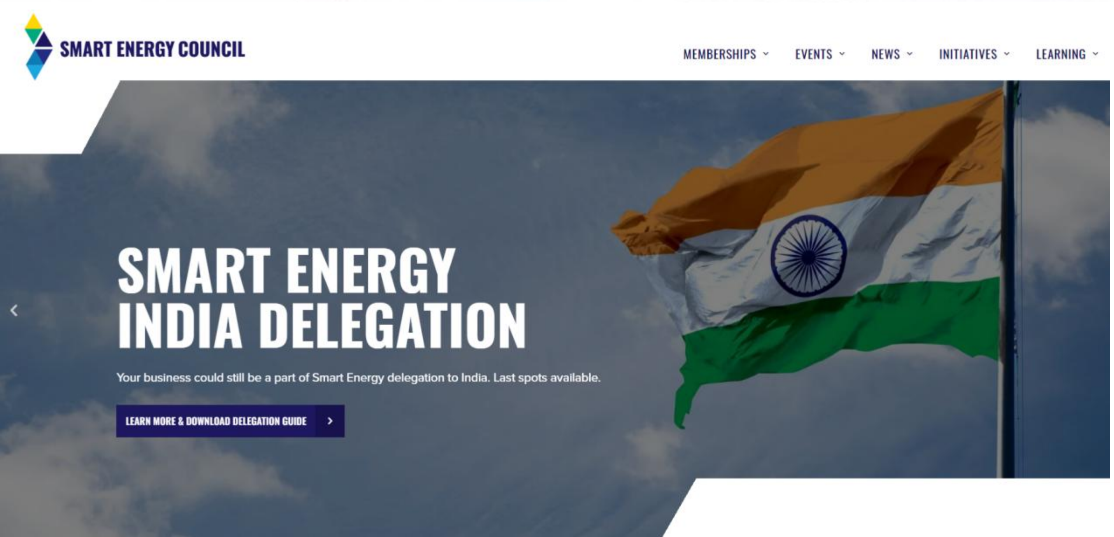

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