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Ad Hoc Group of Experts on Coal Mine Methane

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SUMMARY REPORT OF RESPONSES TO THE QUESTIONNAIRE ON COAL MINE METHANE

Note by the secretariat*

I. SUMMARY

1. The United Nations Economic Commission for Europe (UNECE) carries out a cooperative programme on coal mine methane (CMM) through the Ad Hoc Group of Experts on Coal Mine Methane. These activities are part of a larger effort by the UNECE to promote sustainable development within the energy sector and to enhance international economic cooperation to achieve this goal. In 2006, the Bureau of the Group of Experts and the secretariat prepared and distributed to the Group of Experts a comprehensive questionnaire on CMM (ECE/ENERGY/GE.4/2006/3). The purpose of the questionnaire was two-fold: to establish a foundation for developing the programme of work for the Group of Experts and to document different perspectives and priorities among the various stakeholders within the Group of Experts and, more generally, in the CMM industry. To the knowledge of the Bureau, there has never been a comprehensive survey on CMM such as this. It is believed that the results of this survey will provide further insight into the interests and decision criteria of key industry stakeholders at a critical time in the industry's evolution.

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* Co-authored with Mr. Roland Mader, Chairman of the Ad Hoc Group of Experts on Coal Mine Methane and Mr. Reyno Norval, of Green Gas International.

II. OBJECTIVES OF THE CMM QUESTIONNAIRE

2. The Bureau believes the results of the questionnaire will allow the Group of Experts to better understand the specific interests of its membership providing a foundation to respond to the needs of the member countries and, more generally, the CMM and coal sectors. The results will also assist in identifying prospective areas of focus and the resultant activities that the Group of Experts can and should undertake to bring added value to the industry.

3. With these objectives in mind, the questionnaire consisted of focal areas recognized by industry participants as issues of importance:

(a) Uniformity of definitions for methane in coal seams;
(b) Motives to develop CMM projects;
 (i) Government perspective
 (ii) Private sector perspective
(c) Investment barriers for CMM projects;
(d) Revenue drivers for CMM projects;
(e) Attention clusters for the Group of Experts; and
(f) Specific activities for the Group of Experts.

III. QUESTIONNAIRE DEVELOPMENT AND PROCESSING

4. The Bureau developed the questionnaire in 2005 following the first session of the Ad Hoc Group of Experts. The questionnaire can be found on the UNECE website in English, French and Russian at http://www.unece.org/ie/se/docs/cmm2.html. The secretariat sent the questionnaire to approximately 350 recipients.

5. The secretariat received 83 responses for a total response rate of 24 per cent. Grouping the respondents, they come from 26 countries and 2 international organizations. For analysis, the respondents were grouped according to the status of economic development of the country in which they are based and by type of organization. In terms of economic development, 43 respondents were from developed economies, 32 responses from economies in transition, and 8 from developing economies. Grouping by organization, 16 respondents are employed by research organizations/NGOs, 21 are government staff members, 12 are consultants, 11 are coal company staff, and 23 are investors and/or project developers.

6. The small number of responses from developing economies is a concern. With the exception of China and India, the majority of active and abandoned gassy underground coal mines are located in developed or transition economies. Developing countries are important players in the CMM industry and emissions markets. China's emissions alone account for a third of global CMM emissions, and are expected to rise to 40 per cent by 2020 (US Environmental Protection Agency, 2006). Gassy mines, active and abandoned, also exist in a number of other developing countries including Mexico, Nigeria, South Africa, Vietnam, and Zimbabwe, and may possibly develop in other countries such as Brazil, Columbia, and Indonesia as the coal industries develop and move in to gassy underground seams. With much attention focused on encouraging economic and social development, reducing greenhouse gas emissions,

and fostering emissions markets in these countries, the aim here should be to produce more data on developing economies. This will make the data more statistically significant and produce a clearer insight into the patterns within the developing economies.

IV. SURVEY RESULTS

7. This section describes each of the focal areas, the questions asked of respondents and the responses received. Respondents were asked to rate each issue on a scale of 1 to 5, with 1 representing “very important (High)” and 5 representing “not important (Low)”. All respondents were provided with the opportunity to add their own individual comments. To see the specific questions, reference should be made to the questionnaire at http://www.unece.org/ie in the documents for the second session of the Ad Hoc Group of Experts on Coal Mine Methane. The secretariat has also prepared presentations that provide additional detail on the scores among the various categories of respondents. The presentations can be found in the documents for the third session at http://www.unece.org/ie.

8. The process of analysis included the computation of the raw score (numerical average) to assess the importance of each issue relative to the scale from 1 to 5. The computation of a rank based average score was also used to assess the importance of individual issues relative to other issues within each category of respondents (e.g., coal company vs. investor/developer). Additionally, the standard deviations for all results were calculated to assess the relative variation in responses to specific questions. For example, when comparing the results from the economies in transition and the research organizations, 87 per cent of the results were within 0.5 of a rating. 100 per cent of the time the results were within 1.07 of a rating showing they agree on most areas and rate most factors with the same importance.

(a) Definition of Coal Mine Methane

9. Different terms are often used to describe methane contained in and released from coal seams creating confusion among those wishing to exploit these resources. For example, terms such as coal mine methane, coal seam methane, coal seam gas, coalbed methane, and abandoned mine methane are often used interchangeably, but can also have very different meanings depending on the location and context in which they are used.

10. The development of specialized terminology is a natural outgrowth of any evolving industry, and is often viewed as an indicator of market growth and maturity. On the other hand, many believe that an industry poised for rapid growth with a relatively short window of opportunity such as the CMM industry can ill afford this type of inconsistency and the confusion and uncertainty that result from it. The questionnaire, therefore, sought to clarify whether industry stakeholders believe that universal terms and definitions for the different coal-associated gas streams are appropriate and whether such standardization would benefit the industry. The questionnaire asked first for respondents’ views on the necessity of universal definitions followed by their views on specific terms and definitions.

11. There is general agreement among the Group of Experts that universal definitions are important. The variances are fairly average showing that there are no major disputes within the groups as to the importance of the clear definitions. Conversely, there are differences on how to

define them. Sixty per cent of the respondents agreed with the proposed terms, 25 per cent disagreed, and 15 per cent did not respond.

12. The questionnaire also sought the legal status of terms and definitions in the respondents' countries to determine if they are prescribed in legislation or regulations. Unfortunately, a clear conclusion could not be derived due to the variety of responses. It is believed that respondents answered in different ways due to different interpretations of the question. In fact, there were several instances where persons gave different and contradictory responses for the same country.

13. In summary, although it is apparent that the respondents want clear definitions, even more so in the developing economies, the results gained from the questionnaire do not provide any further clarity. The recommendation may be to form a small informal working group to develop solutions and recommendations for the Group of Experts to consider.

(b) Motives to develop and promote coal mine methane utilization projects

14. All industry participants have some motivation to foster the implementation of CMM projects whether it be for mine safety and health, profit or other goals. In fact, most probably have multiple objectives. Often the motives are aligned among the different stakeholders, but misunderstanding of another's objectives is common in the industry and can undermine progress. The remainder of the questions in the questionnaire provide insight into the views of the respondents given their own circumstances; however this section of the questionnaire sought respondents' views on possible motives to develop CMM projects from both a governmental and a project investor/developer's point of view. This helps to better discern and eventually address misperceptions one group might have towards the other.

15. The following possible motives were presented: direct economic benefits (profits, cost savings); environmental benefits; achieving sustainable development goals
energy security; enhancing coal mine safety; enhancing coal production; economic growth; promoting diplomatic or bilateral/multilateral relations; public safety; and technology transfer/ research, development, and demonstration

16. Table 1 shows the top five reasons for government and private sector interest in CMM project development according to industry stakeholders across all categories. Although not shown in Table 1, energy security, economic growth, and diplomatic relations were not considered to be significant motivating factors for either governments or the private sector.

Table 1: Industry stakeholders' view on Government and private sector motivation to develop and promote CMM utilization projects

Rank	Government	Private Sector
1	Enhancing coal mine safety	Enhancing coal mine safety
2	Environmental benefits	Direct economic benefits
3	Technology transfer	Enhancing coal production
4	Public safety	Technology transfer
5	Achieving sustainable development	Economic growth

17. Coal mine safety was rated highly as a motivation for both governments and the private sector with low variance across all categories of respondents. In addition to mine safety, the results show that industry participants believed governments' interest in CMM projects is also driven principally by the environmental benefits, support for sustainable development, and public safety. Not surprisingly, the private sector was believed to be motivated more by enhancing coal production and profitability. An interesting deviation, though, is that coal companies rated enhancement of coal production very low for the private sector – effectively suggesting that they did not see this as a major benefit of CMM capture and use. This unexpected result may be due to the perception by those outside the mining industry that successful CMM utilization projects can generate sufficient revenue to finance enhanced drainage systems. Although true in some instances, strong coal sales are the principal means of financing mine infrastructure improvements. CMM projects have contributed to such improvements, but have rarely been able to cover the full costs, especially in developing countries in transition economies. This may very well change as carbon markets generate higher revenues that can be reinvested in the mine's drainage infrastructure. Thus, the changing market dynamics could create a need for a comprehensive and integrated approach linking mine safety and profitability.

18. Sustainable development was ranked very low especially for the private sector (with the lowest rating coming from the government organizations in the transition economies) with a variance way below average, signalling that industry participants believed environmental benefits to be a priority for governments but very little motivation for the private sector. These results seem unusual as CMM projects are very sustainable, producing profits while being environmentally and socially beneficial. The reason for the low rank may be due to the concept not being well understood in the community. The low scores may also result from the small size of the projects compared with a general view of sustainable development as having very lofty and broad goals. This may change as carbon prices rise, larger projects are developed, corporate social responsibility and strong governance continue to gain prominence and the private sector will want to publicize their practices.

19. Direct economic benefits were ranked very high (third place) for the private sector, but with a very high variance. In contrast, governments were perceived to rank this much lower, with a much lower variance. A contradiction arises, however, because insufficient profits were ranked very high by both sectors as an investment barrier as seen later in the report. This may be

a misconception due to the differences in understanding, or may be due to government's traditional role as non-profit entity.

20. As might be expected, governments believed that the private sector does not value energy security generated by a CMM project to the same extent as they did. However, for the private sector, the opposite was true – governments did not value energy security as much they did. Most CMM projects are small and their impact on energy security, even collectively, is relatively small. Still, it is not clear why each considered the other less serious about energy security. In addition, it is possible that respondents replied on the basis of different definitions of energy security.

(c) Investment barriers

21. The CMM industry is not unique. Like any industry it faces its share of investment barriers, although these may vary greatly depending on a range of factors. Identification of and agreement on the most significant barriers are important first steps in resolving investment issues and facilitating project finance. The questionnaire presented respondents with 27 investment barriers, roughly grouped into four categories (technical, market, financial and legal/policy) that are often noted as obstacles to project implementation. Overall, the responses provide a better understanding of the experience and perceptions of industry stakeholders, and also clarify countervailing views among those in the industry.

22. Firstly, it was clear that a number of barriers, while possibly important to a limited number of those in the industry or to specific situations, were not considered significant barriers by a majority of participants: (i) ineffective subsurface technology; (ii) lack of a reliable fuel supply; (iii) Surface technology unknown/unavailable; (iv) subsurface technology unknown/unavailable; (v) expatriation of funds for foreign investors; (vi) competing ministerial jurisdictions; (vii) market bias against CMM; and (viii) confusion of terminology (CMM vs CBM (Coalbed Methane)).

23. The top five investment barriers among all respondents are shown in Table 2.

Table 2: Investment barriers

Rank	Investment barrier	Score
1	Insufficient profits	1.70
2	CO_2 credit approval	1.90
3	Limited quality/quantity of resource assessments	2.01
4	Insufficient information	2.03
5	Access to electricity/gas grids	2.06

24. Insufficient profits and CO_2 credit approval were clearly the most important barriers among respondents, and these two investment barriers are directly linked as CO_2 credit approval would have a direct impact on profits. Although developing countries ranked CO_2 credit approval much lower than the other economies (thirteenth with a score of 2.57), experience among industry participants suggests that project sponsors in developing countries still remain

concerned about insufficient profits and lack of capital. The gap between responses and experience could be due to a lack of knowledge about CO_2 credits among those in developing countries or conversely that the market and policy structures for carbon transactions are in place and well-managed in developing countries due to early action in support of the Clean Development Mechanism (CDM).

25. Limited capacity to design, implement, and manage projects due to insufficient information on appropriate technologies, best practices, and project opportunities is often cited among industry participants as a significant barrier to sustainable development in developing economies and economies in transition. The results of the survey support this perception, showing the importance placed by economies in transition (fourth) and developed economies (second) on the quantity and reliability of information for their developers and investors and the lack of such information to make informed decisions. On the other hand, developed economies ranked it only eleventh. Another significant barrier among all respondents is the difficulty in securing mine management support for CMM development, whether it be an internally or externally financed project. The challenges to managing resources for mine operations and the focus on coal production often mean that methane utilization is a low priority. Ownership of the methane resource in coal seams is also often cited as a factor having an impact on project development. Respondents from developed countries, consultants, research organizations and investors all rated this very highly, but other groups rated it as only a moderate barrier. Even then, the variance was very high within the transition economies, on the governmental level and among the coal companies. The responses indicated that clear definition of ownership as a barrier was more an issue for the individual rather than the group as a whole, but the strong views of many respondents suggests that this remains a major issue and should continue to be on the agenda.

26. There was substantial divergence among the different industry sectors after some agreement on the most important barriers. The investors and project developers in particular highlighted the many market and finance barriers they faced, whereas the mining industry was more concerned with operational issues. For example, the lack of power purchase agreements, increased revenue and country risks, and inadequate legal/policy systems were rated very highly by investors/project developers as project barriers but are rated very low by coal companies and developing countries. On the other hand, problems with existing mine safety regulations and a lack of high quality projects to develop were rated very high by coal companies but low by investors/developers. Governments seemed to side with investors on some issues while agreeing with coal companies on others.

27. In addition to the 27 possible barriers listed in the questionnaire, respondents also provided some other interesting barriers to consider: (i) reputation risk of doing business in a country with a poor safety record; (ii) potential is almost maximized in some developing countries so little opportunity left; (iii) the CDM/JI (Clean Development Mechanism/Joint Implementation) approval process is laborious and slow; and (iv) post- 2012 risk is high because there is no system in place after the Kyoto Protocol ends.

(d) Revenue drivers

28. The questionnaire sought to clarify what the industry considers to be the principal revenue drivers for CMM projects listing eight possible revenue drivers, and their rank and score are shown below:

Table 3: Revenue drivers

Rank	Revenue driver	Score
1	Electricity prices	1.45
2	CO_2 credits	1.52
3	Incentives	1.73
4	Gas sale price	1.76
5	Governmental support	1.81
6	Coal mine productivity/safety	1.82
7	Regulatory compliance	2.18
8	Heat prices	2.46

29. Depending on one's perspective, the results may be surprising. Much has been made of the growth and importance of the carbon markets, yet the results showed that many believed electricity prices remain the primary revenue source. Alternatively, there have been many sceptics in the past who have questioned the value of the carbon markets, but the clear message from these results was that carbon credits are as important as electricity prices.

30. Among the top three-ranked responses, there was wide variability among the different groups. For example, while developed and developing countries placed great emphasis on electricity and CO_2 prices, transition economies did not consider them to be as significant, instead ranking coal mine productivity/safety and incentives (e.g., reduced taxes, etc) as the primary revenue drivers. Coal mine productivity was also an important issue for coal companies, but rated low by others.

31. Gas sales prices, governmental support, regulatory compliance and heat prices were ranked moderate to low as revenue drivers by all categories of respondents and provided no real surprises, except possibly that incentives were rated as being more important than gas sale prices. This may be due to the fact that gas sales from CMM projects are limited.

(e) Attention clusters

32. As noted in the introduction, one of the primary objectives of the questionnaire is to assist the Group of Experts to identify a limited set of issues and achievable outcomes of greatest importance to the Group, and then to define the appropriate activities for achieving these objectives. The questionnaire presented seven attention clusters or functional areas, and also sought additional ideas from respondents.

Table 4: Attention Clusters

Rank	**Attention cluster**	**Score**
1	Emission reduction issues	1.52
2	Mine safety	1.69
3	Policy/regulatory	1.75
4	Technology	1.83
5	Finance	1.99
6	Geology	2.09
7	Project management	2.46

33. Emission reduction issues and mine safety stand out as the major issues across all groups of respondents. Emission reduction issues were ranked no lower than third by any one group of respondents, and were rated the most important area of focus by developed countries and investors/project developers. Coal companies also rated emission reduction issues very high at 1.45, which may reflect the growing acknowledgement by coal companies of the economic potential of carbon mitigation projects and the growing interest in CMM projects among investors. Transition economies, research organizations, and governments rated mine safety as their preferred area of interest while developed and developing economies and investors placed it third, albeit with very strong scores. The lowest ranking for mine safety was fourth by consultancies and coal companies. The scores make it clear that the Group of Experts should continue activities in these two areas.

34. Policy/regulatory issues are also very important especially for developing and developed economies. Surprisingly, however, representatives from transition economies rated policy and regulatory development lower than most other issues on a relative scale at sixth, but still considered this important with a score of 1.85. Why is there convergence on this issue between developed and developing economies, but divergence with transition economies when developers/investors continue to express concern about the need for further development of regulatory regimes in transition economies? One reason may be that “policy/regulatory issues” is a very broad term that encompasses regulatory regimes governing labour and commercial operations at coal mines, environmental protection, energy reserves/resources management, and carbon trading. The interpretation of the question and which one or combination of regulatory regimes were considered directly influenced their response.

35. Technology, finance, geology and project management were rated as much more important in the economies in transition compared to the developed and developing economies. Technology¸ especially, rated very high within the economies in transition (average 1.36) making it a close second to mine safety within those countries. In addition, coal companies also placed significant importance on technology and geology rating them first and second, respectively. For the transition economies, technology transfer and mastering difficult geologic conditions were a very high priority and probably explained their interest in these areas. For coal companies, the same is effectively true – their business success is directly tied to technical innovations and an understanding and mastery of the subsurface conditions.

36. It was also suggested that the Group of Experts link CMM recovery and use with other "cleaner fossil energy production" technologies such as carbon capture and storage (CCS) because it may benefit CMM to be considered as part of a portfolio of carbon mitigation technologies.

(f) Role of the Ad Hoc Group of Experts on Coal Mine Methane

37. The final section of the questionnaire sought direction on what activities the Group of Experts should undertake to meet the needs of the CMM industry and UNECE member countries. The answers provided significant insight into where the Group of Experts should establish priorities. In addition to the six listed activities below in Table 6, some additional roles for discussion were proposed. All these will be discussed in more detail at the session in March 2007.

Table 4: Roles for the Ad Hoc Group of Experts on Coal Mine Methane

Rank	Role	Score
1	Organize workshops on clusters	1.55
2	Conferences, promote activities	1.80
3	Initiate pilot projects	1.88
4	Create model for bankable	1.97
4	Compile awareness CD	1.97
6	Initiate a project portfolio	2.05

38. With the exception of interest in organizing workshops on specific clusters, this series of questions generated great variability amongst respondents. Initiation of a pilot project was ranked anywhere from first to fifth (average of 1.40 to 2.14) whilst conferences/promotion of activities and creating a model for bankable documents were ranked from first to sixth (average of ≈1.40 to 2.10). In general, members in developed countries including investors and consultancies saw a strong need for workshops. Reasons for this are that they learn from others' experience, find possible partners and create a network of people and organizations within the appropriate field. Transition economies placed great emphasis on developing a model for bankable projects and initiating a pilot project. Developing countries wanted conferences and were also interested in pilot projects.

39. The pilot project idea was the most disputed issue (highest variance). For example, investors/project developers seemed less interested in pursuing these activities, probably because they would encroach upon and impact their business activities. They also considered the markets to be functioning and might believe that this type of support is no longer necessary. Governments also did not appear enthusiastic about pursuing a pilot project, possibly because of the time and resources involved or they might believe this is not an appropriate role for the UNECE given the involvement of other United Nations organizations such as the United Nations Development Programme and United Nations Industrial Development Organization in establishing pilot projects. Coal companies, transition economies, and developing countries took a complete opposite view, supporting pilot project development to develop the basic skill set and experience necessary to be successful in developing additional projects.

40. Most curious were the responses as to whether the Group of Experts should concentrate efforts on creating a model for bankable documents and initiating a project portfolio. On the surface, these would seem to be aligned and go hand-in-hand with the initiation of a pilot project. However, the opposite is true. Whereas investors/project developers were not supportive of a pilot project, they did encourage the creation of a model for bankable documents and initiation of a project portfolio. Investors/project developers probably see a project portfolio as the more efficient use of resources and also the most beneficial to their needs. Developing and transition countries took the opposite view expressing interest in a pilot project but were not very supportive of a model for bankable documents or a project portfolio. These respondents may see a pilot project as more tangible and action-oriented.

41. Other notable roles identified by respondents included: (i) studying the use of low quality methane, especially methane in the explosive range; (ii) developing a glossary of terms and units used in the CMM industry; and (iii) playing a more active or structured role in disseminating knowledge, contacts and information.

42. Overall, the conclusion that can be drawn is that Group of Experts is not expected to become a project developer but rather to lead the way, playing a more supporting role. The Group of Experts simply does not have the means to accomplish all proposed roles.

V. THE MINING PROFESSIONALS’ POINT OF VIEW

43. This section of the report examines the responses from the mining companies. Investors and governments play a critical role providing capital for projects and creating an enabling environment for their development. Yet it is the coal industry that is most closely linked to projects – a project cannot happen without their authorization. Thus they will normally understand and emphasize concepts that are often overlooked by other groups, and their needs must be met to further project development.

44. For example, coal industry respondents were greatly concerned that mine safety regulations are actually a barrier to development while every other group discounted this as an inhibiting factor. They also had difficulty seeing that there were many projects with great potential. This shows a lack of confidence and demonstrates that the CMM industry and governments have somehow fallen short in selling CMM projects to the mining industry. However, it may also reflect the conservatism within the mining industry and also the focus on mining coal, rather than implementing CMM projects, as a commercial priority. The limited quality/quantity of resource assessments were also a significant issue for the coal industry. Whilst ranked high in aggregate terms by all respondents, there was a substantial margin of difference in the actual scores. It can be argued that this is directly linked with the lack of quality projects to develop as resource assessments underpin the entire investment in a project. Again, it appears that a substantial effort is necessary to aggregate existing information and convince the mining industry that quality resource assessments are possible.

Table 5: Main investment barriers for coal mine operators versus all respondents

Investment barrier	Coal mine	Average rating

	operators	of total group
Existing mine safety regulations	2.00 (5)	2.78 (23)
Lack of high quality/quantity of resource assessment	1.64 (1)	2.01 (3)
Lack of quality projects to develop	2.00 (5)	2.45 (16)

45. The coal industry participants viewed the main revenue driver as coal mine productivity and safety (1.27) but this was not the case for any of the other organizational groups. Overall, coal mine productivity and safety were only rated sixth, although they did receive an average ranking of 1.82. On the other hand, the coal industry placed little faith in incentives ranking them very low, whereas most other organizations and economies ranked these reasonably high. This again demonstrates the focus on coal production and safety within the mining community and that it is critically important that governments, project developers, investors, and carbon traders recognize these priorities and views to be successful in bringing projects to fruition.

VI. CONCLUSIONS

46. The responses to the questionnaire provide great insight into the views of the CMM industry and among the developed, developing and transitioning economies. Until now, opinions on the views of industry stakeholders have largely been based on conjecture, but for the first time these views are documented. Although many responses confirmed previously held observations, there were also some surprises. There are several messages that can be drawn from the responses.

(a) There is a strong interest in uniformity of terminology, but clear differences on how to define those terms. This will be especially challenging where terms are codified in laws.

(b) Mine safety is critical to everyone in the industry and should remain a significant part of the work of the Group of Experts.

(c) Market issues related to revenue generation and carbon credits are also very important for the Group of Experts, and additional work may be necessary in this area. However, there are contrary opinions on the type of activities to undertake in this area: pilot projects, portfolio of projects, and models for bankable documents. Whatever activities are chosen, it must be recognized that there are limits to how much the Group of Experts can undertake.

(d) Policy and regulatory matters are also of importance to the Group of Experts; however, these require further definition to determine what, if any, specific activities can be identified to address these issues.

(e) The views of the coal industry on many of their most critical issues diverge from the other respondents, especially investors. This should provide investors with a better understanding of the needs of the mines for greater effectiveness in their approach to the mining community. Others, in addition to the investment/mining community, could learn from this as well.

(f) There is growing interest in the use of low-quality CMM recognizing that in many countries, especially developing countries and economies in transition, the methane concentration in the gas drainage systems can be below 25 per cent.

(g) The Group of Experts will need to further explore the specific activities that it will undertake to address the issues facing the industry, but focused outreach activities have substantial support.
