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Doevenspeck, Martin

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Martin Doevenspeck

Lake Kivu's methane gas: natural risk, or source of energy and political security?[1]

For a long time Lake Kivu's huge methane gas reserves had only interested limnologists or geoscientists because of the uniqueness of the physico-chemical composition of the lake water. In January 2002 during the eruption of the Nyiragongo volcano on the northern, Congolese shore of the lake, a voluminous lava stream entered the lake. This event highlighted once again the dangers connected with the presence of dissolved gases in the water which evoked the deadly gas outburst of Lake Nyos in Cameroon that killed nearly 2000 people in 1986 (Tietze 1987). Because of its current energy crisis, and driven by the vision of having an almost inexhaustible source of power, Rwanda increased its efforts to establish the first worldwide large-scale exploitation of dissolved methane gas. Hence, new aspects of Lake Kivu's methane reserves have emerged that centre around the sensitive geopolitical question of the use of a common resource shared by the former warring parties, Rwanda and the Democratic Republic of Congo (DRC). This question becomes even more delicate in view of the plundering of the DRC's natural resources during the wars of the last decade.

This article will therefore first analyse the current energy crisis and its political implications in Rwanda and in the eastern DRC, and sketch the origin of methane in Lake Kivu as well as associated natural risks. After a presentation of current methane gas extraction projects in Rwanda and an analysis of the institutional framework, a discussion of the potentials, problems and risks of methane gas exploitation in a post-conflict environment will conclude the paper.

1 Fieldwork was carried out in October 2006. The author conducted numerous interviews in Kigali and Gisenyi (Rwanda), as well as in Goma and Bukavu (Democratic Republic of Congo).

The energy crisis in Rwanda and eastern DRC

Rwanda and the eastern part of the DRC[2] are currently facing a serious energy crisis. Since most of the electricity produced is generated through hydropower, the highly variable climate in central Africa and man-made disturbances of the hydrological cycle expose the power systems to great fluctuation.

Low rainfall is the immediate cause of Rwanda's current gravest electricity crisis since its independence in 1962. Although there is also a lack of investment in Rwanda – no new generating plant has been constructed since 1982 – increasingly significant power cuts are mainly due to the poor performance of the country's most important hydroelectric plants, Ntaruka and Mukunga, in the hills of the Northern Province (former Ruhengeri province). With a production of normally 23 MW these two plants provide nearly half of Rwanda's power.

Since 2004, low lake-water levels due to highly variable rainfall and higher evapotranspiration due to deforestation in combination with strong growth of demand (average GDP rate of 8% a year since 1995), exacerbated by high technical losses and the unreliability of the dilapidated grid, have led to frequent power cuts. The current energy deficit is estimated at 30 MW. With support of the World Bank, the Rwandan government purchased new diesel generation capacity, which has now eased the crisis, at least in Kigali. To cover the costs of diesel imports, the government continues to increase power tariffs, which have trebled since 2004.[3] This landlocked country imports all petroleum products either by truck from Mombasa or through the Mombasa-Nairobi-Kisumu pipeline, and it is feared that high energy costs will affect the booming economy as a whole.

To make up for the shortfall and to cover its minimal energy needs of about 45 MW, the country depends on two additional hydropower plants which were constructed on the Ruzizi River, which runs along the border with the neighbouring DRC. The Ruzizi 1 plant (28 MW) is run by the *Société Nationale d'Électricité* (SNEL), a Congolese government-owned utility that contracted to deliver power to Rwanda at a preferential price.[4] The Ruzizi 2 hydropower station (29 MW) is operated by *Société Internationale d'Electricité*

2 For the purposes of this article (data availability, interconnected power grid), the eastern part of the DRC includes the provinces of Kivu-Sud and Kivu-Nord.

3 In December 2006 people paid €0.17 per kWh which is one of the highest rates in the world (*Financial Times* Dec. 5, 2006, online: <http://www.ft.com/cms/s/f77916c6-8405-11db-9e95-0000779e2340.html>, accessed 08.12.2006).

4 Eastern DRC's power grid has been interconnected with the grids of Rwanda and Burundi since colonial times.

des Pays de Grands Lacs (SINELAC), a joint venture of Electrogaz, Rwanda's state-owned electricity supplier, Burundi's *Régie de Production et Distribution d'Eau et d'Electricité* (Regideso) and SNEL. The main customer for power from the two plants is Rwanda to whom these capacities are especially important for providing Kigali with electricity.

However, both plants use the water from Lake Kivu, which drains to Lake Tanganyika via the Ruzizi River, and, like in northern Rwanda, a falling water level has been observed in Lake Kivu since 2003. Normally the Ruzizi 1 plant is able to regulate the water level of Lake Kivu at between 1463 m and 1462 m above sea level. But in October 2006 it fell to 1461.61 m, which is already critical.[5] An aggravating factor is that one generator is not functional. As a consequence, only 11 MW were produced by Ruzizi 1 at the end of 2006 and if the water level continues to sink the plant risks being shut down, with serious consequences for an entire region depending completely on hydroelectricity.[6] Steadily decreasing water levels in Lake Kivu are caused by a combination of climatic driving forces and the impact of a series of earthquakes that accompanied the eruption of the volcano Nyiragongo in January 2002.[7] In addition to climatic and tectonic factors, extreme wear and lack of maintenance of the existing power generating installations in the eastern part of the DRC can be observed. Thus, hydro stations exhibit a 45% deficit in production, while some small thermal stations continue to suffer from shortages of fuel and plundering (Nile Basin Initiative 2005: 2-20). In October 2006 there were long daily power cuts in the city of Goma because of electricity rationing. Whereas the city needs at least 9 MW, Ruzizi 1 provides merely 3 or 4. Only hospitals and water supply facilities were constantly supplied, having been given priority.

In view of the urgency of security issues in the current transformation phase, the Congolese authorities don't see ending power breakdowns as a top priority at the moment. The directors of SNEL, as well as politicians, are hoping for short-term donor-funding for the rehabilitation of Ruzizi 1, and have long-term plans for new interconnections and an extension of hydro-

5 Author's interview with staff members of SNEL in Goma and Bukavu, October 2006.

6 Author's interview with Director of SNEL in Goma, October 2006.

7 Ground subsidence is an ongoing phenomenon in the entire rift area near Lake Kivu. In January 2002 first measurements by the Goma Volcanic Observatory (GVO) along the northern shoreline from Gisenyi to Sake showed significant ground subsidence: -37 cm in Goma and -10 cm in Gisenyi. One month later maximum measured ground subsidence was 50-60 cm in Goma (Baxter 2002; Tedesco et al 2002; Global Volcanism Program: Nyiragongo, Monthly Reports 2002, online: <http://www.volcano.si.edu/world/volcano.cfm?vnum=0203-03=&volpage=var#bgvn_2704>, accessed 25.11.2006).

power, for which there is a huge potential in the DRC.[8] At present there are no plans in the DRC for power generation using methane gas which is rather seen as a future energy reserve.

The situation in Rwanda is totally different: in view of the over-reliance on energy imports, the dependency on declining hydropower performance, and the lack of sustainable options for expanding existing hydroelectricity capacities, the government is feverishly seeking alternatives. At present it is unable to cope with past levels of demand, let alone the sharp growth in demand of 15% per year that has arisen out of economic growth fired particularly by a boom in the construction sector. If the Rwandan leadership wants to legitimate itself as a guarantor of progress and economic growth, it has to provide affordable energy. As already mentioned, diesel generation as an immediate practical solution to the energy crisis is adding to the economic burden on the country. In addition to this, only 5% of the population is connected to the grid, with 60% of those connected living in Kigali. Ninety percent of Rwanda's 8.1 million people live in rural areas, where electricity provision is still more or less non-existent. Rural electrification would be an effective option for handling the growing, though silent, dissatisfaction with the concentration of development efforts on Kigali.

In this situation the reserves of methane gas in Lake Kivu are seen as an enormous but unused energy source and as a sustainable solution to the country's energy problems. Projects to exploit these resources have top priority for the government at the moment.

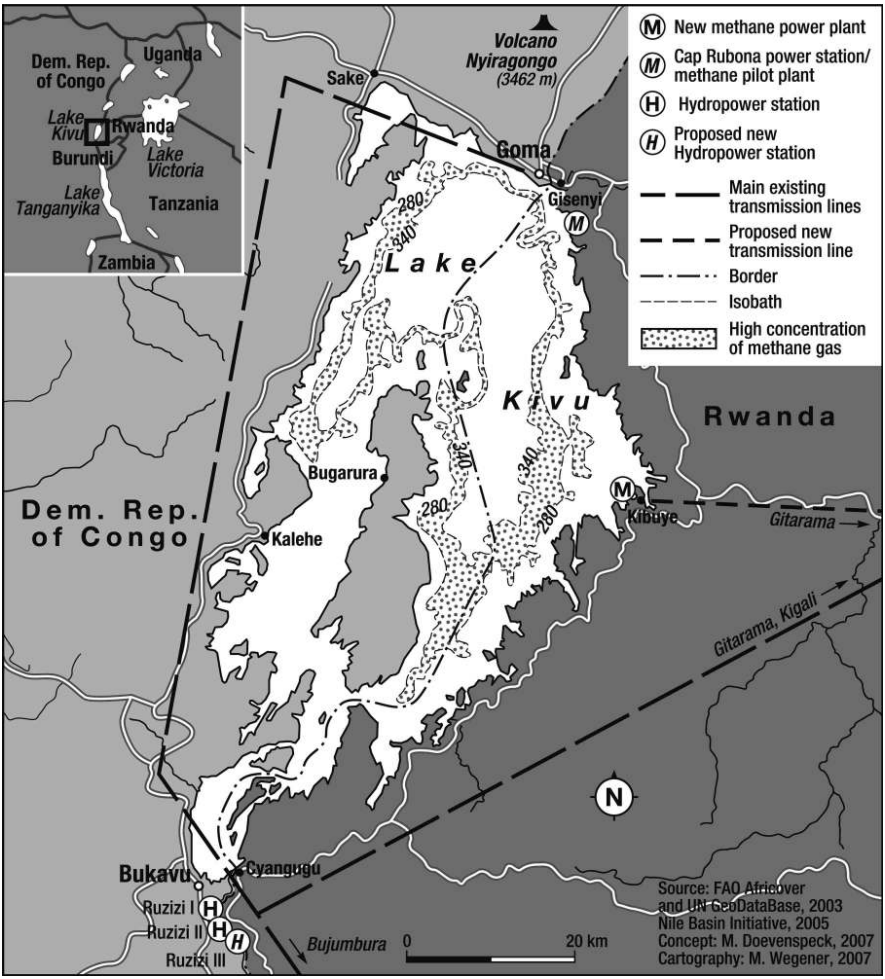
Methane in Lake Kivu as natural risk

As part of the western branch of the African rift valley, Lake Kivu was formed about 500,000 years ago in the course of the emergence of the Virunga volcano chain. It reaches depths of more than 450 m, comprises part of the border between Rwanda and the DRC and covers a surface area of about 2400 km^2, distributed almost equally between the two countries. The lake is unique in the world because its deeper waters contain an enormous quantity of dissolved gas: estimates range from 250 billion m^3 of carbon dioxide (CO_2) and 50 to 55 billion m^3 of methane gas (CH4).[9]

8 Planners especially discuss investments in the Inga complex on the Congo River in western DRC that is said to have a potential of 39,000 MW (Marot, 2003).

9 Dissolved gases in Lake Kivu were first described in the 1930s. It also contains 5 billion m^3 of nitrogen and traces of many other gases. Numerous scientific studies have confirmed the huge reserves of methane since the 1950s (see for example Tietze 1978 and Halbwachs et al. 2002).

Lake Kivu: methane gas deposits and the electric power supply infrastructure



Though not fully known the lake's carbon dioxide seems to be partly of volcanic origin as well as formed by the decomposition and fermentation of organic material by anaerobic bacteria accumulating in the bottom sediment. Methane is generated by fermentation processes and by the reduction of volcanic carbon dioxide by the same bacteria (Tietze et al. 1980). It is estimated that 100 to 150 million m^3 of methane are generated annually in the lake. Like other lakes the waters of Lake Kivu show a stratified structure with stable horizontal homogenous layers which have different physical and chemical properties. The highest concentrations of carbon dioxide and methane were measured in layers below the depth of 270 m where high-density gradients prevent any mixing phenomena, thus facilitating the gas accumulation.

There are only two other lakes in the world containing similar concentrations of dissolved gas: Lake Monoun and Lake Nyos in Cameroon. In 1986, a CO_2 outburst from Lake Nyos killed 1800 people who died of asphyxiation. The dissolved gas had reached saturation level, so that an uncontrolled ex-solution process began,[10] and, as inside an opened bottle of champagne, when the pressure fell, bubbles rose to the surface, drawing up the water with them and triggering a chain reaction that resulted in the deadly gas outburst. An enormous quantity of carbon dioxide was liberated, killing people and animals in the surrounding valleys (Tietze 1987).

In its normal state the stratification of Lake Kivu is stable. The gas concentrations have not yet reached the dangerous magnitudes of Lake Nyos, let alone a saturation level that could lead to a gas outburst.[11] But even if the carbon dioxide concentrations are much lower, a risk remains for the population of about two million people living on Lake Kivu's shores, due to the presence of dissolved methane. Simulations of physical mixing in the lake show that if the current methane production remains stable a dangerous concentration of the gas composition could be reached in about hundred years. But this time span will diminish if methane production within the sediment continues to increase at the rate measured recently (Schmid et al. 2004, 2005). Lake Kivu contains a thousand times more gas than Lake Nyos, and since the methane accounts for more than 4/5 of the total gases in Lake Kivu, it is feared that it will function as a 'detonator' for the enormous quantity of carbon dioxide.

10 Ex-solution means the formation of gas bubbles in an over-saturated liquid. In the case of a lake the saturation limit of the waters depends on the total quantity of dissolved gas and the pressure (depth). Ex-solution occurs when the sum of partial pressures of all dissolved gases reaches hydrostatic pressure.

11 Measurements showed saturation levels of 57% for methane at a depth of 290 m and 8% for carbon dioxide at 280 m depth (Halbwachs et al. 2002: 2).

Furthermore, the current stability of the lake is threatened by distinct seismic and volcanic activity in the region. The January 2002 eruption of the volcano Nyiragongo, probably caused by a tectonic fracture between the active plates of the African Rift Valley, destroyed large parts of the city of Goma, situated on the north-western shore of Lake Kivu. Since one of the huge lava streams with a width of 600 m ran through the city centre and entered the lake, the people in Goma and neighbouring Gisenyi in Rwanda feared that the hot lava could have disturbed the stability of the lake, thus making a future gas outburst even more likely. Immediate investigations showed that the one million m^3 of lava only reached a depth between 70 and 100 m and that the disturbances of the water stratification were limited to a depth of 120 m. This was distant enough from those layers with the highest gas concentrations but if a stronger lava inflow reaches depths below 250 m in the future a serious situation could build up (Halbwachs et al. 2002: 8-23). Since there are numerous volcanic cones at the bottom of the northern basin, Schmid et al. (n.p.: 15/17) investigated the potential impact of heat input in the deep waters. They concluded that such an input must be exceptionally strong to trigger a gas outburst but that 'the required heat input will strongly decline if the dissolved gas concentrations further increase in the future'.

In respect of the debate on the risk constituted by dissolved gases in Lake Kivu, we can say that the present possibility of a massive gas outburst is low, provided no significant disturbance occurs, such as a very strong heat input into the lake. However, to reduce the remaining risk of such an event, which could have a devastating impact on the entire Lake Kivu catchment area of 10,000 km^2; scientists postulate a controlled degassing of the lake, as has been carried out in Cameroon (Schmid et al. 2003). But, contrary to the case of Lake Monoun and Lake Nyos, where carbon dioxide is released into the atmosphere, the focus here is on methane gas extraction for the purpose of power generation and is thus linked to concrete economic interests.

Current projects for methane gas extraction in Rwanda

The first and, up to now, the only operational industrial exploitation of Lake Kivu's methane is the Cap Rubona Power Station, near Gisenyi on the Rwandan shore of the lake. It was built in 1963 by *Union Chimique Belge* not far from a local brewery that uses the gas as fuel. Planned to operate as a pilot plant, it has become a purely commercial project, selling 5000 m^3 of

purified methane per day to the brewery.[12] Cap Rubona Power Station is managed today by the *Unité pour la Promotion et l'Exploitation du Gaz du Lac Kivu* (UPEGAZ), a body within the Rwandan Ministry of Infrastructure. Its success led to numerous studies on the technical, economical and environmental feasibility of a large-scale exploitation of Lake Kivu's methane, which also address the possible applications such as power generation, vehicle fuel, a substitute for firewood and various chemical applications.[13]

As one example of current projects for methane gas extraction one has to mention Dane Associates Limited (DANE), a special-purpose company registered in Scotland and trading locally as 'Kibuye Power 1 Limited' (KP1). The plan is to build a new power plant near the district town of Kibuye that will use methane from Lake Kivu.[14] The World Bank has granted a risk guarantee to KP1, a public private partnership between DANE and the Rwandan government, which is contributing 30% to cover the estimated costs of about 60 million Euros. In March 2005, DANE and the government of Rwanda signed a gas concession agreement and a power purchase agreement. After an expanded testing phase for the upgraded gas extraction technology, it is hoped that KP1 will produce 35 MW to be injected into the national power grid and sold by Electrogaz, which will buy it from KP1 at about 0.05 € per kWh.[15] It is hoped that the additional quantity of cheaper power will reduce the cost of electricity in Rwanda by 50%.[16] The economic performance of KP1 is being closely watched by a group of Rwan-

12 The technology of gas production in Cap Rubona is relatively simple: water from a depth of around 300 m is conducted to a separator under the lake surface through two pipes. When pressure becomes progressively lower the gases come out of the solution. The separator then liberates more gas and separates it from the already partially degassed water. The resulting gas mixture of about 70% carbon dioxide and 30% methane is enriched by several 'washing processes' which uses the shallow waters to dissolve the unwanted carbon dioxide. The end product of about 80% methane, 18% carbon dioxide and 2% nitrogen is compressed and transported to the brewery by pipeline (<http://www.upegaz.gov.rw/faisabilite.html>, accessed 02.12.2006)

13 UPEGAZ provides a list of 20 studies on Lake Kivu's methane gas on its website (<http://www.upegaz.gov.rw/historique.html>, accessed 02.12.2006).

14 DANE's shareholders are two limited companies registered in the British Virgin Islands (Ainsley International Limited) and in Cyprus (Selenge Enterprises Limited). Other investors are the Finnish Wartsila Cooperation that supplies the power generators and operates the project and the Israeli Ludan Engineering Company Limited, responsible for the gas extraction plant.

15 Africa Power 2006: 4; INICA n. d.

16 According to Rwandan newspaper The New Times, the KB1 project now risks to fail since DANE didn't pay its share of the initial investment. The Rwandan government is taking DANE to court in this matter and has withdrawn its sub-loan offer for the project (The New Times; 1, 9 and 11 February 2007).

dan businessmen who are ready to invest over 30 million Euros in a similar methane project to be realized with South African technology.[17] However, further plans go far beyond these 35 MW, which will be easily absorbed by a ravenous national energy market. The medium-term aim is to produce 200 MW and to reach an electrification rate of 30% of all households by 2020.[18] The Rwandan Minister of Energy has even talked about 700 MW,[19] a twenty fold increase of Rwanda's current energy production that could make the country an important net exporter of affordable power in Central and East Africa.

Surprisingly, one crucial fact is not mentioned in the various scientific reports and the extensive coverage of current and future methane gas extraction in the national and international media: Lake Kivu's methane is a common resource shared by Rwanda and the DRC and there is no contract granting one of them the exclusive right of exploitation. To generate 35 MW it will probably be necessary to extract between 55 and 60 million m^3 of methane per year, but the methane consumption for a 200 MW scheme (315-340 million m^3 per year) or even a 700 MW scheme (over one billion m^3 per year) for export purposes, as announced by Rwandan government officials, will largely exceed the self-regeneration capacity of Lake Kivu's methane.[20] What may be welcome with regard to a reduction of a possible gas outburst is not unproblematic in view of Rwanda's involvement in the exploitation of eastern Congo's natural resources during the wars of the last ten years. Even if Johnson & Tegera (2005) have shown that the problem of resource exploitation in the DRC is a complex structural problem and thus cannot be reduced to 'illegal' practices by foreign aggressors, statements like that of the Rwandan Minister of Energy are suspiciously watched on the Congolese shores of the lake.[21] Against this background, power generation using methane gas from Lake Kivu is an important issue in the recommencing bilateral

17 Author's interview with the chairman of the Rwanda Private Sector Federation (RPSF) in Kigali, October 2006. Several companies have expressed interest in gas projects on Lake Kivu (e.g. First Trading House, Ixora, Equatoria). German company *W+S Beteiligungs AG* together with *Deutsche Montan Technologie GmbH* (DTM) seems to be ready to sign a $ 100 million contract on methane gas extraction with the Rwandan government (<http://presseportal.de/story.htx?firmaid=61635>, accessed 17.01.2007).

18 Author's interview with staff members of UPEGAZ in Kigali, October 2006.

19 BBC News, <http://news.bbc.co.uk/2/hi/africa/4698278.stm>, accessed 21.11.2006.

20 It is estimated that from 50 to 55 billion m^3 of methane about 40 billion are economically exploitable.

21 'If Rwanda exploits methane gas from the lake to produce electricity and then wants to sell it to us we can't accept. It's also our gas, isn't it?' Author's interview with a staff member of SNEL in Goma, October 2006. Similar statements were given by other officials as well as non-officials in Goma and Bukavu.

relations between Rwanda and the DRC, as well as an element affecting international efforts for economic progress and political stabilisation in the region.

Energy projects and a new Great Lakes cooperation

On the international level there are two larger initiatives promoting common energy projects explicitly as part of broader approaches to achieving sustainable peace in the Great Lakes region: the International Conference on the Great Lakes Region (ICGLR)[22] and the faint-heartedly resuscitated Economic Community of the Great Lakes Region Countries (*Communauté Economique des Pays des Grands Lacs*, CEPGL).[23] The idea behind is to reduce enmity, to bolster up mutual dependency, and to provide economic benefits for all parties involved.

On the ICGLR level there is a project for methane gas exploitation and the construction of a gas pipeline from Lake Kivu to eastern DRC, Rwanda, Burundi, Tanzania and Uganda, but the realisation of this ambitious scheme hasn't gone beyond the stage of a proposed feasibility study (ICGLR 2005). In view of the enormous need for technical and financial input, as well as political commitment and the security aspects of a pipeline that have not yet been analysed in detail, it can be assumed that this project will not be realised in the medium term.

Pushed by former Belgian Foreign Minister Louis Michel, Burundi, the DRC and Rwanda announced the relaunch of CEPGL in 2004 and made proposals for common rehabilitation projects in respect of the Ruzizi 1 and Ruzizi 2 hydropower stations. Since joint exploitation of methane gas has no priority, and since the regional *Banque de Développement des Etats des Grands Lacs* (BDEGL), which was intended to manage potential funds for these CEPGL projects from the World Bank and the European Union, is virtually bankrupt, it is not surprising that Rwanda is spurring on its own methane projects in order to overcome its energy crisis as fast as possible.[24]

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22 ICGLR is an on-going process for negotiations and consultations on poverty and conflict in the sub-region with participants from the government and civil society from the participating countries. Assisted by the United Nations and the African Union ICGLR runs a temporary office in Nairobi where it also held its second summit in December 2006. The heads of State signed the Dar es Salaam Declaration as a call for common programmes of action and projects. For further information, see Sebhara 2005 and <http://www.icglr.org>.

23 CEPGL was founded in 1976. As a result of the different wars in and between the member states Burundi, Rwanda and Zaire/DRC in the 1990s, it gradually lost its significance.

24 There is also dissent within the European Union concerning common projects. In view of the insecurity and political instability in the region, one fraction is worried about the loss

With SOCIGAZ (*Société Commerciale et Industrielle pour la Mise en Valeur du Gaz Méthane*), Rwanda and the DRC already dispose theoretically of a bilateral instrument for the mediation of diverging interests in the methane sector. SOCIGAZ was created by the two countries within the CEPGL framework in 1990 with the aim of promoting the industrial exploitation of methane gas. After the first Congo war (1996-97), SOCIGAZ got a new mandate and since 1999 it is formally responsible for controlling exploitation, concessions and licence fees. But with the reform of SOCIGAZ both states now also have the right to assign concessions for their territory, an important precondition for Rwanda's current exploitation project.

SOCIGAZ is indeed the appropriate organ for cooperation regarding the exploitation of methane, but, like other institutions within the CEPGL framework, after 10 years of war between the member states and internal conflicts within them, at the present time it doesn't function at all. In reality, SOCIGAZ, which according to its charter is always headed by a Congolese General Director, serves more or less as the semi-official Congolese contact for Rwanda's Unit for the Promotion and Exploitation of Lake Kivu Gas (UPEGAZ) and represents the DRC's interests in the development of the KP1 project.

Rwanda currently appears to have a sincere interest in the political safeguarding of its methane extraction project and in getting the DRC on board, which has the same right to Kivu's methane.[25] First bilateral talks between the two Ministers of Energy were held in Kigali in December 2005, followed by a meeting of experts in April 2006, also in Kigali. Both events were organised by UPEGAZ. During these meetings, the Congolese side was informed about details of KP1 and provided with different studies on the feasibility and potential environmental impacts of methane gas exploitation. Congolese fears were discussed regarding the possible impact of falling water levels in Lake Kivu, due to methane gas extraction, on the already poor performance of Ruzizi 1 and Ruzizi 2 power stations, on which the Congolese border region relies heavily.[26] Both sides expressed their willingness to cooperate more closely in the future and the Congolese delegation declared its support for the KP1 project. However, the Congolese insisted on reviving agreements reached during the modification of SOCIGAZ's man-

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of investments through potential future conflicts. Author's interviews with a staff member of CEPGL in Gisenyi and a European Union official in Kigali, October 2006.

25 In 1975 Rwanda and Zaire signed the Bukavu treaty in which the two countries agreed on a common exploitation of the gas. Since the problem is about dissolved gas in the depth of the lake it is very difficult to number the respective share of methane resources for each country, especially if one brings to mind that an extraction is followed by balancing through water flows.

26 Author's interview with the coordinator of UPEGAZ in Kigali, October 2006.

date in 1998 regulating financial compensation in the case of unilateral methane exploitation exceeding the self-generation rate.[27]

Rwanda, represented by UPEGAZ, claims that it is extremely difficult to find reliable and long-term negotiating partners in the DRC, due to ambiguous and frequently changing competences. Now Rwanda has come up with a new initiative for a so-called Lake Kivu Monitoring Programme, which is primarily established as a technical controlling, inspecting and regulating programme to preserve the lake's stability during large-scale industrial methane exploitation. One has to observe whether the initiative will also serve as a political platform for negotiations between the riparian countries of Lake Kivu and to which extent the government of Rwanda wishes the Congolese to participate in it. UPEGAZ proposed a basic plan for the programme that envisages a scientific workshop for end of march 2007, the elaboration of laws and rules for exploitation, and a baseline survey also for 2007. A 'Kivu Monitoring Group' shall be integrated in the Nile Basin Initiative and in the Common Market for Eastern and Southern Africa (COMESA).[28]

Open questions

Several open questions remain regarding the future development of industrial methane gas extraction in Lake Kivu. A first one concerns the current disaster discourse. As it was pointed out, a huge gas outburst is relatively unlikely as long as no significant disturbance of the lake's stability occurs (e.g. strong heat input into the lake). Yet nearly all studies and reports emphasise the positive effect of methane exploitation for disaster risk reduction, even if the annual medium-term volume of exploited gas were to be largely inferior to the regeneration rate.[29] None the less disaster risk reduction is also regularly cited by Rwandan officials in order to counter Congolese concerns about their neighbour's solo attempt in the methane sector.[30] By contrast there is very little discussion about the potential industrial disaster risks of large scale methane exploitation. With the exception of Tietze (2000), who mentions the high risk of an accident if extraction is performed improperly, most authors and consultants avoid this question. An incident

27 Author's interview with the General Director of SOCIGAZ via telephone, December 2006.

28 Author's interview with UPEGAZ staff member in Kigali, October 2006.

29 An exaggerated disaster vocabulary is very common in the coverage of the methane issue. See for example Isager 2006

30 'They should be glad; we're going to degas the lake'. Author's interview with government official in Kigali, October 2006.

during extraction could affect the Congolese population as well and thus provoke tension between the two countries.

The same holds true for potential environmental effects. Whereas methane gas is advertised as a substitute for wood, thus stopping deforestation in Rwanda, methane's real substitution potential is quite uncertain in view of the low prices of wood fuel and the highly dispersed settlement structure. Moreover, no environmental study has been carried out to investigate the impact of destabilisation of the lake on the fish population. Lastly, it is not clear what should be done with the by-products of methane exploitation, especially carbon dioxide.[31] Pumping it back to depths below 270 m is too expensive and would affect the costs. Pumping it to depths between 10 and 50 m would only delay its release into the atmosphere. If CO_2 is completely released, this would affect methane's reputation as a 'green' alternative to diesel.

As already mentioned, the Kivu Monitoring Group is Rwanda's proposal to address all these problems. But the question is whether it would not be more useful to restructure SOCIGAZ and reinforce its capacity as the appropriate organ for questions concerning the common use of Lake Kivu's methane deposits, instead of establishing a new institution that is perceived as dominated by Rwanda.

It is obvious that landlocked Rwanda needs to push methane exploitation in order to overcome its current energy crisis. Sufficient and affordable power is an important precondition for further development and therefore for the fragile stability of the war- and genocide-torn society. In addition, as an exporter of power, the country would strengthen its influence in the regional political setting and make an important step forward in its efforts to become a member of the East African Community (EAC). But Rwanda is caught between a rock and a hard place. It has to further its own methane projects but it is also aware that a sustainable and long-term exploitation strategy must include the DRC's interests as well as protect its own rights. This is not easy in a situation where official diplomatic relations are still not really re-established and tensions continue.[32] Against this background, bilateral negotiations in the methane sector appear much more advanced than those on a general level, and an often mentioned vision is that common methane projects could deepen mutual dependency and acquire the same

31 There is four times more carbon dioxide in the water than methane gas.

32 Rwanda was not invited to President Kabila's swearing-in ceremony and President Kagame confounded DRC's officials when he expressed his readiness to send troops back into Congo if the Interahamwe rebels attacked Rwanda (The East African, December 18, 2006).

importance as Ruzizi 2 hydropower station, which was managed jointly even in wartime.

The realisation of potential common projects in the methane sector also depends on the condition of the state in the DRC. In this respect one has to observe whether President Joseph Kabila can consolidate power after last year's elections and what kind of impact this consolidation will have on local political order and the performance of state institutions especially in the still Rwandan influenced eastern part of the DRC. Without reliable contacts and stronger commitment from the DRC, real cooperation is impossible. It is also clear that for a lot of Congolese this will cost quite an effort in view of the recent history of the two countries. If methane extraction in Rwanda works technically and financially and does not adversely affect the environment, the DRC would be well advised to develop its own methane projects as it is not conceivable that Rwanda will stop exploitation just because it has already consumed half of Kivu's methane.

The political effects of the industrial exploitation of Lake Kivu's methane gas and its dynamic institutional framework should be incorporated in future research on the regional conflict situation. The possibility of developing a common strategy for the exploitation of the Lake Kivu methane deposit and to ensure that profits are redistributed fairly amongst the parties involved is intrinsically tied to the well-known problems of political instability which encumber relations between Rwanda and the DRC: the presence of the ex-FAR/Interahamwe in the DRC which was used as the justification for Rwanda's decision to send in troops and the situation of the Rwandophone population in the Kivus.

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Martin Doevenspeck (PhD, University of Bayreuth, Germany) is an Assistant Professor of Social Geography at the University of Bayreuth. He is responsible for the Centre for Natural Risks and Development Bayreuth (Zentrum für Naturrisiken und Entwicklung Bayreuth, ZENEB), an interdisciplinary network for social science oriented disaster and risk research in developing countries (www.zeneb.uni-bayreuth.de).