

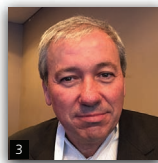
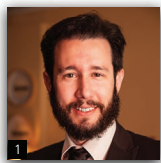
# Editorial: XV Pan-American Conference: Selected papers on energy geotechnics

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## Introduction: The XV Pan-American Conference

This themed issue of *Environmental Geotechnics*, XV Pan-American Conference: Selected papers on energy geotechnics, presents some of the papers of the XV Pan-American Conference on Soil Mechanics and Geotechnical Engineering (XV PCSMGE) that are of particular interest to readers in the emerging energy geotechnics topic and that were highly ranked by the conference paper reviewers. PCSMGE is the largest regional conference of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE), involving two regions of the ISSMGE, and is held every 4 years.

The first PCSMGE was held in Mexico City, Mexico, 7–12 September 1959. It was convened by an ad hoc committee under Enrique Tamez, Secretary. The 15th, and latest, PCSMGE was held in Buenos Aires, Argentina, 15–18 November 2015, 40 years after Argentina hosted its first Pan-American conference in 1975. The XV PCSMGE coincided with three important events for geoprofessionals: the VIII South American Conference on Rock Mechanics (VIII CSMR), the 6th International Symposium of Deformation Characteristics of Soils (IC-BA2015) and the XXII Argentinian Congress of Soil Mechanics and Geotechnical Engineering (CAMSIG XXII).

This event brought together about a thousand people not only from the Americas but from around the world, including international experts, researchers, academics, professionals and geoengineering companies, who exchanged ideas and discussed current and future practices in the areas of soil mechanics, rock mechanics and their applications in civil, mining, petroleum and environmental engineering.

The main topics of the XV PCSMGE conference were

- transportation geotechnics
- in situ testing

- geoengineering for energy and sustainability
- numerical modelling in geotechnics
- foundations and ground improvement
- unsaturated soils
- embankments, dams and tailings
- excavations and tunnels
- georisks.

During the conference, a total of 19 keynote speakers (including three plenary lecturers), seven invited speakers, and 25 panellists from local and global Industry and academia provided a review of topics and innovation, which are of interest to the geocommunity, under the conference theme ‘From fundamentals to applications in geotechnics’. In addition, a total of 435 peer-reviewed technical papers were presented and discussed in oral, ‘agora’ (i.e. interactive poster) and poster presentations. Through these interactions, advanced knowledge and ideas were interchanged, allowing cross-fertilisation and promotion of a true community of colleagues in geotechnical and geoenvironmental engineering. These conference papers have been compiled as digital and printed proceedings (Manzanal and Sfriso, 2015).

The authors of the highest ranked papers in the third conference stream, ‘Geo-engineering for energy and sustainability’, were invited to resubmit an extended version for this issue of *Environmental Geotechnics*. These papers are of particular relevance to the members of the ISSMGE Technical Committee 308, Energy Geotechnics, and the readership of the journal interested in sustainable development and energy derived from the ground.

## Contributions to this issue: energy geotechnics at the XV PCSMGE

In the last few years, geotechnical/geoenvironmental engineering has shaped a new research area, energy geotechnics, in an effort to respond to the increasing demand of energy associated with

Table 1. Energy resources and associated geotechnics involvement (modified from Santamarina and Cho, 2011)

| Non-renewable (fossil fuels)                                                             |                                                                                                       |                                                                                                          | Renewable |                                                                     |                                                     |                                                        | Nuclear                                                                                        |
|------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|-----------|---------------------------------------------------------------------|-----------------------------------------------------|--------------------------------------------------------|------------------------------------------------------------------------------------------------|
| Coal                                                                                     | Gas                                                                                                   | Petroleum                                                                                                | Solar     | Geothermal                                                          | Wind                                                | Biofuels                                               |                                                                                                |
| Characterisation, subsurface response, mine excavation and instability, and gas recovery | Hydrates, low-temperature liquefied natural gas storage, hydraulic fracturing, and optimal extraction | Fines and clogging, sand production, borehole instability, enhanced oil recovery, heavy oil and tar sand | –         | Drilling, fracture formation, heat transfer, piles and optimisation | Off-/on-shore foundations and pseudodynamic loading | Land and water use, energy efficiency, and food impact | Engineered soils, decommission, leak detect and repair, and long-term behaviour and monitoring |

economic development and population growth (Ghaaowd *et al.*, 2017; Sánchez *et al.*, 2017). Indeed, since the industrial revolution, the human population growth and the annual per capita energy consumption have increased exponentially (Glassley, 2010).

Mitigating the environmental impacts of an ever-growing population has become inextricably linked to find renewable and more sustainable energy sources (Arulrajah *et al.*, 2015). Table 1 presents a comprehensive overview of all energy resources, including fossil fuels, renewable and nuclear sources, together with some of the issues where geotechnical engineering expertise is needed (Santamarina and Cho, 2011). Indeed, there are a number of geotechnical needs in the growing renewable energy sector as well as in the non-conventional fossil fuel exploitation, which have been summarised elsewhere (Sánchez *et al.*, 2017; Yun *et al.*, 2011). The paper by Sánchez *et al.* (2017) presents the main discussions and comments associated with the expert panel on ‘Geo-engineering for energy’, ranging from oil and gas exploitation to carbon geosequestration and energy efficient technologies.

It is generally agreed that a combination of measures is needed to reduce greenhouse gas emissions, including the use of alternative, renewable and sustainable energy sources and of more energy efficient technologies. Here, heat transfer and fluid flow in geomaterials and their influence on the geomechanical behaviour of soils and rocks play critical roles. The estimation of thermal parameters of geomaterials becomes then, important, and new ways of estimating such parameters are needed (Hailemariam *et al.*, 2017). These parameters are of the upmost importance in engineering design and predictive modelling: the fundamental understanding of the influences of heated soils on the development of excess pore water pressures in thermal storage technologies (Ghaaowd *et al.*, 2017) and/or in the long-term prediction of geomaterial behaviour in nuclear repositories (Jacinto and Ledesma, 2017) are some examples of the contributions made by the geo-community to energy geotechnics.

One of the engineering applications concerning ground thermo-mechanical response involves the use of ground source heat pumps or shallow geothermal technology (Sánchez *et al.*, 2017), which can be used even under extreme climate conditions, for example to control frost heave and the thaw settlement of frozen ground beneath an ice rink facility in Helsinki (Iceland) (Sinnathamby *et al.*, 2017).

This issue of *Environmental Geotechnics* also deals with other emerging technologies, some in the pathways to commercialisation, such as new cleaner coal technologies using underground coal gasification (Sarhosis *et al.*, 2017) or coalbed methane recovery, which also enables carbon sequestration (Lee *et al.*, 2017); and exploitation of methane gas hydrates and the required modelling of the mechanical response of their host sediments (Gai and Sanchez, 2017).

Advanced geotechnical and geoenvironmental techniques, including advanced laboratory and in situ testing and numerical modelling methods, continue to develop at a rapid pace, as demonstrated by the papers in this issue, which captures just a snapshot of the diversity and importance of energy geotechnics within our disciplines.

## Acknowledgements

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