**Notification: Evaluating, validating and improving the site-response component of the Groningen Risk Assessment**

**Organisation: Ministry of Economic Affairs and Climate Policy (MEA)**

**Purpose of the notification**
The purpose of this notification is to determine whether there are parties interested to perform the above mentioned evaluation.

**State of the art, background**
Natural gas in the Netherlands is produced in many onshore and offshore gas fields. The Netherlands has one of the largest onshore fields of the world in Groningen. This gas field has produced for many decades. Associated to the gas extraction activities, induced earthquakes as well as subsidence are occurring. Magnitude and frequency of the earthquakes has been increasing up to midst 2014, and the largest events have caused damage to buildings. The observed damage patterns and ground motions are spatially strongly variable and difficult to forecast. This is a fact difficult to explain to the public and raised during the MEA / NCG (Nationaal Coördinator Groningen) knowledge platform meetings (see annex II of the KEM Research Framework).

In the NAM Groningen risk assessment, site response is embedded in the Ground Motion Prediction Equation (GMPE). There have been substantial efforts undertaken to understand and constrain the local site amplification. This is validated using measurements of shallow seismic velocities and then extrapolated based on geological knowledge. The most recent seismic recordings, especially at new sites that have become available as part of the seismic network densification in Groningen, have not yet been used to validate and improve the site response module. Also, alternative approaches may be available in the literature and applied in other places. Furthermore, there are a number of locations, where ground motions do not fit the predictive model well. This raises concerns about the general validity of the model. Finally, the relative importance of non-linear effects and upscaling to stronger ground motions needs to be explored.

**Objective**
Local site amplification in the Groningen area is an important factor influencing the damage potential. Site amplification is observed to be spatially highly variable, due to the complex geological setting especially of the shallow subsurface (e.g., loosely packed sands, peat and clays). The NAM Groningen risk assessment implemented a detailed layer of local site response, in parts based on micro-zonation measurements. It is important to independently evaluate and validate this model, also against the most recent data observed with the densified seismic observation network. The objectives/research questions of this project are thus:

1) To evaluate the site response model, its sensitivities and the quality and resolution of the data available to constrain it.
2) To validate how well the model performed against the most recent data, thus evaluating its forecasting skill.
3) To propose additional measurements or model improvements that would reduce the uncertainty in predicting local ground motions.

**Timeline**
Final report by the end of 2018.

**Required skills / experience**
- Excellent geotechnical expertise on seismic site response modelling
- Knowledge of GMPE

**Application**
Interested companies / consultants, fitting the above mentioned requirements, are invited to respond to the Procurement Office of the Ministry of Economic Affairs and Climate Policy, to the attention of Ms. Marjolein Switzar by e-mail IUCEZteam5@rvo.nl.

You do not have to send documents, only an e-mail if you are interested. Only if you send an e-mail your will receive the documents.

Interested parties will receive the request for the tender by e-mail, as soon as possible after the deadline for responding to this Notification.

The deadline for responding to this Notification is set at **27 June 2018**, 12.00 CET.