URR and Time Series Estimation

on Availability of the Global Conventional Hydrocarbon Resources:

estimation based on the discovery transition path of each basin

(世界の在来型炭化水素資源の究極可採埋蔵量と時系列的利用可

能量の推定：各堆積盆地の発見履歴に基づく推定)

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Abstract.

Estimation of the ultimate recoverable resources (URR) of conventional hydrocarbons has been made by using newly developed model of hydrocarbon discovery process and the comprehensive hydrocarbon field database. Subsequently, time series estimation on future availability of conventional hydrocarbon resources has been performed.

Estimations were based on historical pattern of discoveries in each particular exploration area. Hydrocarbon discoveries according to the exploration activities in a particular area, represented by the number of drilled exploration wells, were categorized into 12 field size classes and the discovery patterns of each size class have been simulated by the proposed discovery process model based on gamma function, which is characterized by the simple analytical properties and flexibility. In the process of formulation of the proposed model, three intermediate adjusted models (adjusted model A, adjusted model B, and adjusted model C) were introduced. The purpose of introduction of those adjusted models was to relate the exploration efficiency and the geological attributes such as area of fields, total area of a basin, or total area of all basins in a region, to the model parameters. Fitting results of all models have been analyzed and compared. Consequently, the proposed generalized discovery process model showed the highest overall performance and the forecast ability.

Finally, the generalized discovery process model was applied to a comprehensive EDIN database of IHS Markit provided by courtesy of JOGMEC. The discovery process of each size class fields in each region has been modeled by the proposed generalized discovery process model and the ultimate number of fields in each size class has been estimated for each region. Ultimate number of fields was multiplied by the average 2P reserves of hydrocarbon in corresponding size class and aggregated to obtain the estimated URR.

Normalized production profile for each size class has been estimated using the historical production data and the 2P reserves of the mature fields. The relationship between the oil price and the exploration activities, represented by the annual number of exploration wells, has been analyzed and the number of exploration wells drilled per year has been projected under several future oil price scenarios. The future discovery of fields has been estimated by the discovery process model for each size class in each region and aggregated. Assuming 3 years of time lag from discovery to start of production and applying the normalized production profiles to the estimated discoveries of the fields, time series of future availability of conventional hydrocarbon resources has been estimated.