8.2 Evaluation Model for Choice of Oil Shale Processing Technology - RESOURCE

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For the long history of the oil shale industry different methods of use were applied. For mining and extraction of oil shale: open pit mining, strip mining, underground mining, in-situ combustion, in-situ heating, combined methods. Many processing methods were invented, tested and developed:

- with movable or immovable shale;
- with gaseous or solid heat carrier; vertical or horizontal movements of shale and heat carrier in all combinations, crossing, collateral or reverse;
- rotating or immovable reactor;
- pneumatic, gravitational or mechanical transportation of oil shale and heat carrier;
- external or internal heating;
- in-situ or ex-situ heating;
- with different sources of heat - combustion (of shale, coke or gas), electricity, explosion, microwaves, plasma;
- allowing and not allowing co-processing;
- more or less friendly to environment;
- with different capacity, capital and operational costs;
- with different products of different quality and prices.

How to compare them to make a choice? By final result – which one brings more profit for the same block of oil shale deposit. For this purpose the Evaluation Model for Choice of Oil Shale Processing Technology (RESOURCE) was elaborated. The model considers:

R – processed share of Resource; R = processed oil shale / resources of oil shale;
E – Extracted energy; E = energy extracted & recovered / HHV of processed oil shale;
S – Spent energy; S = energy spent for mining and processing / energy extracted & recovered; (S=1/EROEI);
O – energy Output; O = R * E * (1-S);
U – Unit profit; U = (unit price – unit cost) / oil price; where the unit is BOE (barrel of oil equivalent) of energy output, and cost does not include environmental charges;
R – Rate of resource use; R = O * U;
C – Commodity by-products; C = specific net receipts from by-products per unit / oil price;
E – Environmental Charges; E = specific environmental costs / oil price.

The final result, calculated as F=(R + C – E), shows which share of in-situ oil shale resources with energy expressed in BOE at current market oil price will make profit. Some of known processing methods have been evaluated: ICP – 0.07, Galoter – 0.43, Kiviter – 0.05, Petrosix – 0.14, ATP – 0.33, Tosco II – 0.32, IGT – 0.39, Lurgi – 0.37.