



**Al-Ayen University**

College of Petroleum Engineering

# Petroleum Engineering Economy

**3d year student**

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Lect (11)

## Lecture (11) 1117

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Profit or loss equation:

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The viability of any business venture can be expressed as the difference (either profit or loss) between revenue and costs.

In other words:

**Profit or (Loss) = Revenue – Costs**

in modern business, this simplistic equation becomes complicated by various forms of taxes and tax provisions (الأحكام الضريبية), such as depreciation (الاستهلاك) and allowable depletion calculations (حسابات النضوب المسموح بها). Such complications—plus the accounting procedures they have engendered (تولدت)—obscure (حجبت)؛ the financial performance of most businesses.

However, there is a second reason why most business ventures (المشاريع التجارية) today are not so simplistic: money is often invested months before revenues begin to be generated and years before profits begin to be realized. Profits are not received as lump sums (مبالغ مقطوعة) or even in

predictable installments (أقساط يمكن التنبؤ بها). Also, maintenance costs are incurred (تكبدها) repeatedly during a project's lifetime. So the time value of money invested and received must be taken into account.

### Evaluating a producing property (تقييم الممتلكات المنتجة)

The purchase of any oil and gas producing property is a complex business venture. The basic economic equation for evaluating a producing property is as follows:

يعتبر شراء أي ممتلكات منتجة للنفط والغاز مشروعًا تجاريًا معقدًا. المعادلة الاقتصادية الأساسية لتقييم الممتلكات المنتجة هي كما يلي:

$$P = (N \cdot R \cdot X \cdot W) - T - C - F - I$$

where

- $P$  = After-tax profit or (loss), expressed as present value of the cumulative net cash flow stream. (الربح أو (الخسارة) بعد الضريبة ، معبرًا عنه .) (بالقيمة الحالية لصافي التدفق النقدي التراكمي)
- $N$  = Net revenue interest (الفوائد الصافية للإيرادات)
- $R$  = Reserves (المخزون)
- $W$  = Wellhead price (سعر رأس البئر)
- $T$  = Wellhead taxes (ضرائب رأس البئر)
- $C$  = Operating costs (تكاليف التشغيل)
- $F$  = Federal income taxes (ضرائب الدخل الفيدرالية)
- $I$  = Investments (الاستثمارات).

Several important observations can be made about Equation (2). First, the owners of the producing property usually pay 100% of the costs but receive a reduced proportion—ordinarily from about 70% to 87.5%—of the revenue from production. This reduced proportion is the *net revenue interest* (NRI). The remainder goes to the royalty owners—generally the landowner. Second, the equation expresses the profit or (loss) as if it were a "lump sum" payment, whereas it is actually received over a long period of time, a net cash flow stream combining production decline, price fluctuations, expenses (including taxes), and inflation. Third, to consider the **time value of money**, the net cash flows are expressed as a *discounted* cash flow stream, so the entire venture can be compared to current alternative financial investments. Wherever a dollar value is expressed as a *present value* (PV), it means that the value has been discounted to reflect the time value of money.

يمكن إجراء العديد من الملاحظات الهامة حول المعادلة (2). أولاً ، يدفع أصحاب الممتلكات المنتجة عادةً 100٪ من التكاليف لكنهم يتلقون نسبة مخفضة - عادةً من حوالي 70٪ إلى 87.5٪ - من عائدات الإنتاج. هذه النسبة المخفضة هي صافي يذهب الباقي إلى أصحاب الملكية - (NRI) الفائدة على الدخل

بشكل عام مالك الأرض. ثانيًا ، تعبر المعادلة عن الربح أو (الخسارة) كما لو كانت دفعة "بمبلغ إجمالي" ، بينما يتم استلامها فعليًا على مدى فترة زمنية طويلة ، وهي عبارة عن تدفق نقدي صافي يجمع بين انخفاض الإنتاج وتقلبات الأسعار والنفقات (بما في ذلك الضرائب) والتضخم. ثالثًا ، للنظر في القيمة الزمنية للنقود ، يتم التعبير عن التدفقات النقدية الصافية كتدفق نقدي مخصوم ، بحيث يمكن مقارنة المشروع بأكمله بالاستثمارات المالية البديلة الحالية. عندما يتم التعبير عن القيمة ، فهذا يعني أنه تم خصم القيمة (PV) بالدولار كقيمة حالية لتعكس القيمة الزمنية للنقود.

### Expected net present value equation for drilling ventures.

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The financial value of any proposed oil or gas drilling venture can be evaluated by assuming a successful project (Equation 2) and by adding one additional important consideration: the chance of success or failure. This leads to the expected value of the venture, as shown by Equation (3):

Expected Net present Value(ENPV)=Chance of Success-Chance of Failure(after tax –dry hole cost+ associated geotechnical and lease cost)

Thus, *expected net present value* (ENPV) (صافي القيمة الحالية المتوقعة) represents the risk-weighted value (القيمة المرجحة بالمخاطر) of a proposed drilling venture. Assuming accurate and consistent perception of both reserves

and chance of success, ENPV represents the probabilistic value of each venture and thus becomes a primary tool for decision-making and program forecasting.

The ENPV is the average value that could be expected if the venture or similar ventures could be repeated many times. Some ventures **المشاريع** will result in successes and some will result in failures, but on the average, we expect to make the expected net present value.

The next questions (covered in the next two chapters) concern methods for estimating (1) reserves, rates, and costs, and for estimating (2) chances of success and failure.

Cash flow:

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What is Cash Flow? Cash flow refers to **the net balance of cash moving into and out of a business at a specific point in time**. Cash is constantly moving into and out of a business. For example, when a retailer purchases inventory, money flows out of the business toward its suppliers.

ما هو التدفق النقدي؟ يشير التدفق النقدي إلى الرصيد الصافي للنقد المتحرك داخل وخارج العمل في نقطة زمنية محددة. ينتقل النقد باستمرار إلى العمل التجاري والخروج منه. على سبيل المثال ، عندما يشتري بائع تجزئة مخزونًا ، يتدفق المال من الشركة نحو مورديه.

Cash Flow from Investing Activities is cash earned or spent from investments your company makes, such as purchasing equipment or investing in other companies. Cash Flow from Financing Activities is cash earned or spent in the course of financing your company with loans, lines of credit, or owner's equity.

التدفق النقدي من أنشطة الاستثمار هو النقد المكتسب أو المنفق من الاستثمارات التي تقوم بها شركتك ، مثل شراء المعدات أو الاستثمار في شركات أخرى. التدفق النقدي من أنشطة التمويل هو النقد المكتسب أو المنفق في سياق تمويل شركتك بقروض أو خطوط ائتمان أو حقوق ملكية المالك.

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## What Is Cash Flow?

The term cash flow refers to the net amount of cash and cash equivalents being transferred in and out of a company. Cash received represents inflows, while money spent represents outflows.

يشير مصطلح التدفق النقدي إلى المبلغ الصافي للنقد والمعادلات النقدية التي يتم تحويلها داخل وخارج الشركة. يمثل النقد المستلم التدفقات الداخلة ، في حين أن الأموال المنفقة تمثل التدفقات الخارجة.

A company's ability to create value for [shareholders](#) is fundamentally determined by its ability to generate positive cash flows or, more specifically, to maximize long-term [free](#)

cash flow (FCF). FCF is the cash generated by a company from its normal business operations after subtracting any money spent on capital expenditures (CapEx).

يتم تحديد قدرة الشركة على خلق قيمة للمساهمين بشكل أساسي من خلال قدرتها على توليد تدفقات نقدية إيجابية أو ، بشكل أكثر تحديدًا ، هو FCF (FCF) لتعظيم التدفق النقدي الحر على المدى الطويل النقد الذي تولده الشركة من عملياتها التجارية العادية بعد طرح أي (CapEx) أموال يتم إنفاقها على النفقات الرأسمالية.

## KEY TAKEAWAYS

- Cash flow is the movement of money in and out of a company.
- Cash received signifies inflows, and cash spent signifies outflows.
- تدل النقدية المستلمة على التدفقات الداخلة ، والنقد المنفق يدل .. على التدفقات الخارجة.
- The cash flow statement is a financial statement that reports on a company's sources and usage of cash over some time.<sup>1</sup>
- • بيان التدفق النقدي هو بيان مالي يقدم تقارير عن مصادر الشركة واستخدام النقد على مدار بعض الوقت
- A company's cash flow is typically categorized as cash flows from operations, investing, and financing.
- عادةً ما يتم تصنيف التدفق النقدي للشركة على أنه تدفقات <sup>1</sup> نقدية من العمليات والاستثمار والتمويل.



- There are several methods used to analyze a company's cash flow, including the debt service coverage ratio, free cash flow, and unlevered cash flow
- هناك العديد من الطرق المستخدمة لتحليل التدفق النقدي للشركة ، بما في ذلك نسبة تغطية خدمة الدين ، والتدفق النقدي الحر ، والتدفق النقدي غير المعتمد.

## **Cash flow: Their estimation and diagraming**

Cash flows are inflows and outflows of money. These cash flows may be estimates or observed values.

(قد تكون هذه التدفقات النقدية تقديرات او قيم لوحظت).

Every person or company has cash receipts—revenue and income (inflows); and cash disbursements—expenses, and costs (outflows).

(كل شخص أو شركة لديه إيصالات نقدية - ثنائيات والدخل (تدفقات) ؛ والمصروفات النقدية - التعقيدات ، والتكاليف (التدفقات الخارجية).)

These receipts and disbursements are the cash flows, with a plus sign representing cash inflows and a minus sign representing cash outflows.

هذه الإيصالات والصرف هي التدفقات النقدية ، مع علامة زائد تمثل التدفقات النقدية وعلامة ناقص تمثل التدفقات الخارجية.

Cash flows occur during specified periods of time, such as 1 month or 1 year.

Of all the elements of an engineering economy study, cash flow estimation is likely the most difficult and

inexact.

ايجاد التدفق النقدي أصعب وعدم الدقة

Eni estimates investment in Zohr gas processing plant at \$5 Billion. Italian Eni has estimates the cost of implementing the Zohr gas treatment to be \$5bn with a capacity of 3.2bn cubic feet of gas daily in order to connect the production of the project that estimating 2.9 bn cu feet (News in 2018). Total cost more than 12 milion \$.

Petroleum industry characteristic:

1-significance.

2-globalization.

3-Exploration Risk.

How do we Run the business:

● **Oil companies.**

- **Majors and Supermajors.**

(Like Chevron, Exxon mobile, BP.....etce)

**Which gain More than 200Milion Dolars in revenue.**

- **Independence. Companies smaller than Majors which have 20 -50 million dollars as profit. smaller than one. Thiere work focus in upstream and som times mid and down stream.**

**-Major Resource holders (MRH) or National oil companies(NOC).Example Aramco, Kuwaite.**

وعادة هذه الشركات تكون حكوميه ومنظمه لعمل الشركات ووسطيه  
مثل شركة ارامكو وشركة الكويت وعادة تعمل في ال up ,Mid and  
Down stream.

**-Government sponsored enterprises.**

**Example: Statoil hydro in Norway, OGC in India, or Petrobras in Brazil.**

●Integrated service companies.

Big Service company like Backer hugs, Haliburton.

●Specialized service companies.

Specialized in one work like drilling.

●Refineries, Petrochemical and/or Chemical Companies. they buy crude oil and treat them to produce fules lke gas benzene naphtha and also petrochemists. then these companies sell this products.

●Transportation Companies.

**Petroleum Economics**

النفقات الراسماليه Capex

النفقات التشغيليه Opex:

**Up stream Project Development.**

**1-Exploration,2-Appraisal(drill 2 wells at least),3-Development,4-Production.**

**Capex and opex:**

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**1-Capital expenditure leads to creation of (Capital) assets which add to the capacity of the system.**

يؤدي الإنفاق الرأسمالي إلى إنشاء أصول (رأسمالية) تزيد من قدرة النظام.

**2- operating expenses can be deducted from taxable income immediately.**

يمكن خصم مصاريف التشغيل من الدخل الخاضع للضريبة على الفور.

**Capex and opex have different fiscal treatment.**

النفقات الرأسمالية والنفقات التشغيلية لها معاملة مالية مختلفة.

**Capital Costs:**

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- Drilling costs.
- completion costs.
- facilities construction costs.
- Facilities upgrades.
- Adding perforation in new zones.
- Fracturing in New zones.

## Operating Costs:

- Transportation costs.
- Labor Costs.
- Cost of Supervision.
- Supplies.
- Cost of Operating the pumps.
- Electricity.
- Repairs.
- Chemical Fuels.
- Other incidental expenses.

●تكلفة النقل.

●تكاليف العمالة.

●تكلفة الإشراف.

●الإمدادات.

●تكلفة تشغيل المضخات.

●الكهرباء.

●الإصلاحات.

●الوقود الكيميائي.

●المصاريف النثرية الأخرى.

## Unit Technical Costs(UTC)

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- The sum of the Capital Costs and operating costs divided by the number of barrels produced or(Ultimately produced).
- The UTC is often used by decision Makers as a yard stick for a first rough screening of projects.

Economic yardsticks: المقاييس الاقتصادية

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- Measure that do not consider the time value of money.
  - Profit
  - Pay out
  - Exposure.
  - Cost to find, develop reserves.
- Measure that do consider the time value of money.
  - Rate of return( $i_r$  or ROR).
  - Net present value( $P_{pv}$  or NPV).
  - Discounted profit- to –investment ratio (DPI)

### Cost of finding reserves:

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**Cost** to find and develop reserves=**Investment/Reserves.**

=\$/bbl or \$/Mscf

### Variation of finding and developing cost:

- **Finding cost:** usually consider exploration cost divided by reserves(usually Proven).
- **Development cost:** usually considers development costs(CAPEX) required to develop divided by reserves.

### Time value of money:

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$$\text{Present value} = FV_n / (1+i)^n$$

▪ Comments

*i is now called "discount rate"*

$1/(1+i)^n$  is called "discount factor"

Interest is calculated at end of time period.

$$NPV = \sum_{j=1}^{j=n} (R_j - E_j - I_j) / (1+i)^j$$

If  $j$  and  $n$  are years-and  $i$  is interest rate per year

This equation is for payment at end for each year.

### Economic yard sticks:

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- Net present value(NPV).
- Internal rate of return(IRR).
- Average value profit(AVP).

**-Pay back period.**

**-Profit to onvestment Ratio(P/I).**

**There is a set of metrics used to analyze/compare investment opportunities. These metrics are often referred to as economic yardsticks and they include:**

**1.Net Present Value (NPV)**

**2.Actual Value Profit (AVP)**

**3.Internal Rate of Return (IRR)**

**4.Payback period(PB).**

**5.Profite to investment(P/I).**

**Each metric has its pros and cons, but when they are used collectively, they can lead to an informed decision. This is especially helpful in petroleum engineering where there may be collective group of mutually exclusive investment opportunities and it is imperative to select the best outcome. In this video we are going to look at two of these metrics: NPV and IRR. NPV and IRR take into account the time value of money and therefore are can be categorized as discounted economic yardsticks. In the video I will explain both of these concepts. Further, I will work through a petroleum engineering example, determining**



**NPV and IRR from gas production decline data and develop a present value profile as shown in the figure below:**

