**ОДЕСЬКА НАЦІОНАЛЬНА АКАДЕМІЯ**

**ХАРЧОВИХ ТЕХНОЛОГІЙ**

**ЗБІРНИК ПРАЦЬ**

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# МІЖНАРОДНИЙ НАУКОВИЙ ОРГКОМІТЕТ

| | | |
|---|---|---|
| **Єгоров** *Богдан Вікторович* | – | голова, Одеська національна академія харчових технологій, ректор, д.т.н., професор |
| **Бурдо** *Олег Григорович* | – | вчений секретар, Одеська національна академія харчових технологій, д.т.н., професор |
| **Атаманюк** *Володимир Михайлович* | – | Національний університет «Львівська політехніка», д.т.н., професор |
| **Васильєв** *Леонард Леонідович* | – | Інститут тепло- і масообміну ім. А.В. Ликова, Республіка Білорусь, д.т.н, професор |
| **Гавва** *Олександр Миколайович* | – | Національний університет харчових технологій, д.т.н., професор |
| **Гумницький** *Ярослав Михайлович* | – | Національний університет „Львівська політехніка”, д.т.н., професор |
| **Долинський** *Анатолій Андрійович* | – | Інститут технічної теплофізики, почесний директор, д.т.н., академік НАН України |
| **Зав'ялов** *Владимир Леонідович* | – | Національний університет харчових технологій, д.т.н., професор |
| **Сукманов** *Валерій Олександрович* | – | Полтавський університет економіки і торгівлі, д.т.н., професор |
| **Колтун** *Павло Семенович* | – | Technident Pty. Ltd., Australia, Dr |
| **Корнієнко** *Ярослав Микитович* | – | Національний технічний університет України „Київський політехнічний інститут”, д.т.н., професор |
| **Малежик** *Іван Федорович* | – | Національний університет харчових технологій, д.т.н., професор |
| **Михайлов** *Валерій Михайлович* | – | Харківський державний університет харчування та торгівлі, д.т.н, професор |
| **Паламарчук** *Ігор Павлович* | – | Національний університет біоресурсів та природокористування України, д.т.н., професор |
| **Снежкін** *Юрій Федорович* | – | Інститут технічної теплофізики, директор, д.т.н., академик. НАН України |
| **Сорока** *Петро Гнатович* | – | Український державний хіміко-технологічний університет, д.т.н., почесний професор |
| **Сухий** *Констянтин Михайлович* | – | ДВНЗ "Український державний хіміко-технологічний університет", д.хім.н., професор |
| **Тасімов** *Юрій Миколайович* | – | Віце-президент союзу наукових та інженерних організацій України |
| **Товажнянський** *Леонід Леонідович* | – | Національний технічний університет „Харківський політехнічний інститут”, д.т.н., професор, член-кореспондент НАН України |
| **Ткаченко** *Станіслав Йосифович* | – | Вінницький національний технічний університет, д.т.н., професор |
| **Черевко** *Олександр Іванович* | – | Харківський державний університет харчування та торгівлі, ректор, д.т.н, професор |
| **Шит** *Михаїл Львович* | – | Інститут енергетики Академії Наук Молдови, к.т.н., в.н.с |

# СЕКЦІЯ 1.

# ІННОВАЦІЙНІ РІШЕННЯ ПРОБЛЕМ ЕНЕРГОЗАБЕЗПЕЧЕННЯ

**Література**

1. Ілляшенко С. М. Управління інноваційним розвитком промислових підприємств: монографія / С. М. Ілляшенко, О. А. Біловодська. – Суми : Університетська книга, 2010. – 281 с.
2. Економіка і організація інноваційної діяльності / О. І. Волков, М.П. Денисенко, А. П. Гречан та ін.; під ред. проф. О. І. Волкова, проф. М. П.Денисенка. – 3-є вид. – К.: Центр учбової дітератури, 2007. – 662 с.
3. Юрова О.В. Мотивация труда в контексте инновационной деятельности / О.В. Юрова, И.А. Небыков, М.А. Виноградова [Електронний ресурс]. – Режим доступу: http://www.be5.biz/ekonomika1/r2012/2278.htm.
4. Бундюк А.М. Методичні аспекти адаптації особливостей планування інноваційного проекту підприємств енергетичної галузі / А.М. Бундюк, Л.М.Карпенко, І.В. Полешко // Aganda Pablishing Hous. Coventry United Kingdom Belgium, 2018. p. 30-32.
5. Ковтуненко К.В. Мотивационный менеджмент: Учебное пособие / К.В. Ковтуненко, А.Н. Бундюк – Одесса: «Імперія друку», 2018. – 238 с.
6. Бундюк А.Н. Управление рисками внешнеэкономической деятельности:: Учебное пособие / А.Н. Бундюк // – Одесса, MSC-CS, 2018. - 240 с.

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# ENERGY POLICY OPPORTUNITIES. HOW TO FACE CHALLENGES

**Bezhan V., Pryazovskyi State Technical University Mariupol, Ukraine**
**Zhytarenko V., Pryazovskyi State Technical University, Mariupol, Ukraine**
**Ostapenko O., Odessa National Academy of Food Technologies, Odessa, Ukraine**
**Yakovleva O., Odessa National Academy of Food Technologies Odessa, Ukraine**

**Abstract.** Energy Policy Opportunities should be relied with a systemic perspective on energy innovation. Such approach put requirements to design effective energy policy portfolios using directed innovation activity plan. Our team contribute a standardized set of technology-specific meters which describe methods all the way through the energy technology innovation system, covering from publications to policy mixes and energy market share.

**Key Words:** Energy Policy, Energy Sector, Energy Efficiency, Energy Investment.

For clear understanding where Ukraine are and what way to go, to reach required goals, global observation of world energy policy players give opportunities to define best practices for developing Effective Energy Policy which is not powerful without systematic approach. Cause in each outer and inner process which influences on system elements interaction during system performance. Ukraine is in position of translator for West modern and innovative technologies which are ground and facilitator for Energy Policy development now. Ukrainian legislative base directed on energy and environment is floating long away from any activity of industry which is trying to follow West colleagues within Energy Sector to get profit and to create image in order to move toward world market. Ukrainian scientific society is hard working to fulfill this gap. The problem is to be a good politician is not a deal you understand industry requests in full manner. Just close collaboration in between engineers' society and politicians can help highlight the problems to overwhelm energy sector barriers and to attract investment into desired sectors of Energy.

**Global Energy Investment**

In order to start accepting energy policy opportunities we look through analytical research of global investment in energy. Global energy investment covered 1.8 trillion US dollars in 2018. More oil, gas and coal supply expenses was compensated by lower investment on fossil-fuel based generation and renewable power. Efficiency spending was unchanged. Power sector is attracted the maximum investment, greater than oil and gas third year in a row.

In 2018, China was the largest market for investment in Energy Sector, but its lead position constricted. The US and India improved the furthermost during previous 3 years, rest of regions have been less active, reflecting lower oil prices in Middle East, rebalancing between old and new parts of the energy system for Europe and financing risks management in sub-Saharan Africa.

Energy supply expenses has moved approximately to projects with shorter lead times, relatively reflecting investor desire to illuminate risks amid uncertainties for the long-term tasks portfolio of the energy system. Investment purchasing power has risen overtime in some sectors. Changing for cost drops, investment in renewable power is up 55% ever since 2010, and cost deviations have hindered the influence of less oil and gas expenses since 2014 [1].

Benchmarking current tendencies in contradiction of future needs proposes moving forward energy supply investment in somewhat scenario. But the energy policy opportunities and risks differ significantly, depending on the way that the world players follow.

Modern investment tendencies are not gone step-on-step with where the world seems to be heading. Approvals of new-started conventional oil and gas projects are lacking of highlighted requirements to meet sustained robust demand growth.

Data of a key reallocation of capital which is obligatory to bring investment in line with the Paris Agreement and pointed sustainable development goals have poor sings.

Even as expenses goes down in particular areas, investing active process in low-carbon supply and demand is delaying, cause of insufficient policy focus to address persistent risks. In the Sustainable Development Prognoses, the investment in low carbon technologies increases up to 65% by 2030, but progressing from nowadays share of 35% would require a step-by-step change in policy emphasis, innovative financing solutions at consumer and bulk power levels and faster technological progress, including more RD&D, amid sustained spend on electricity grids.

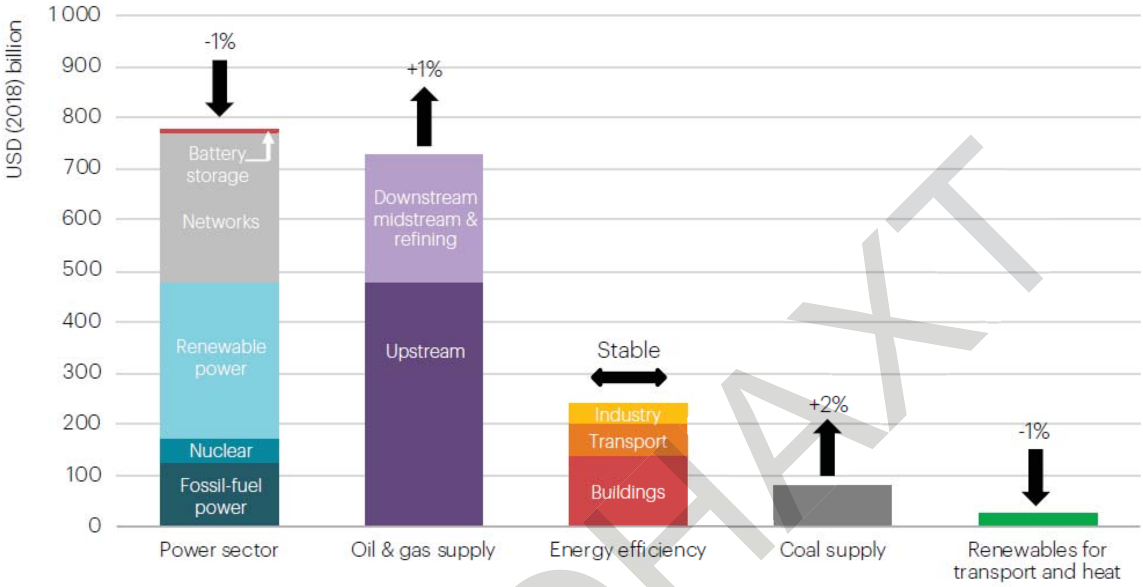


**Figure.1 Global energy investment in 2018 and change compared to 2017 (Adopted from IEA)**

For several years, power exceeded oil and gas supply pointed as one of the biggest investment area (Fig.1). Due to flowing costs in both sectors, the tendency reveals the increasing importance of electricity, whose demand growth in 2018 was approximately two times as fast as overall energy demand.

A 1% fall down in power sector investment goes from less spending on coal power in the China and gas power in the US. Investment in renewables reduced, as net additions to capacity were flat and expenses cut down in particular technologies. That was supported by plants under development.

Energy efficiency outgoings was stable for 2 years, with limited progress in intensifying energy policy coverage.

Investment in coal supply sector raised by 2% since 2012 – although the total remains a long way below the peak levels reached at the start of the decade.

Renewable heat and transport sector investing fall down, but spending on new biofuels plants grew.

Resulting world dynamic, Ukraine as global player should go aside from fossil fuels, to make much more attention to Energy Efficiency projects development, to attract investment for research and development in renewable power within power sector.

Dramatically reducing energy intensity within Ukrainian power industry is a best choice. Research works directed vapor generated systems optimization and design innovative, energy effective systems both in the power sector and metallurgy can bring greater contribution for moving Ukraine toward decarburization and meeting Paris Agreement requirements.

**Shifting costs have reformed the investment landscape in some energy areas**

Following information on Fig.2 we can claim that investment in solar PV and LEDs technologies development can make more profit while integrating renewables in energy sector to build “green” and/or “zero” energy buildings.

First step from industry to invest in projects with shorter construction times that can limit capital at possible risk. For upstream oil, gas and power generation, the industry is carrying capacity to market on typicaly more than 20% faster than at the start of the last decade.

It shows improved project management as well as economics for shorter cycle technologies along with industry competition. In power sector, capital cost drops – influencing technology progress, location for its realization – have been reduced on 75% in solar PV since 2010, onshore wind fall down 20% and battery storage reduced on 50%. In offshore wind, capital cost declines for commissioned projects have been less dramatic, but rising utilisation rates and lower financing costs have driven prices in auctions to new lows.

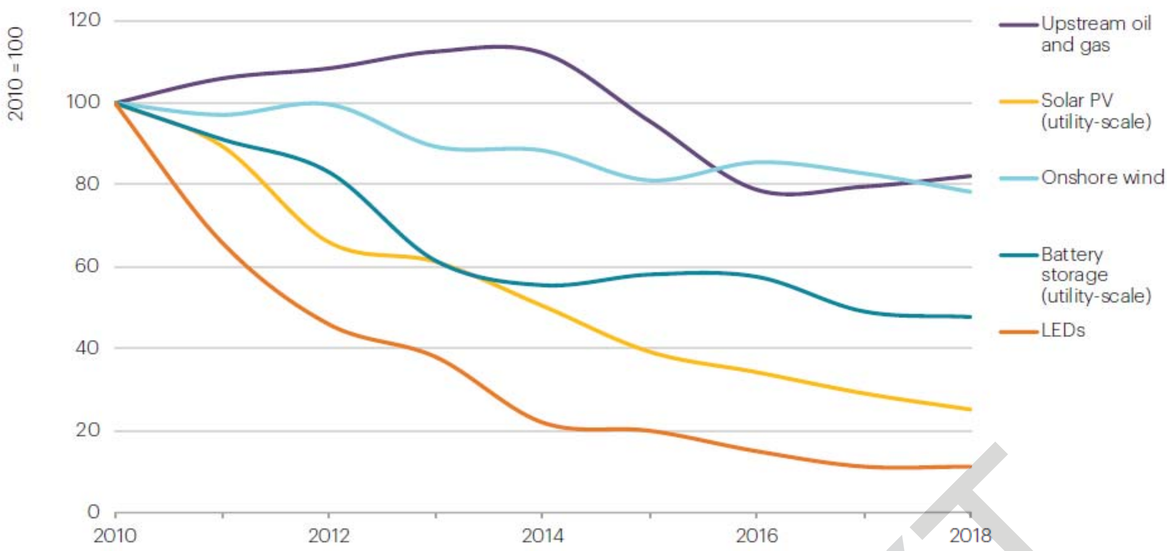


**Figure.2 Capital costs in particular energy sectors**

LEDs - light-emitting diodes, PV - photovoltaic. Capital costs reflect global weighted average costs of components or commissioned projects in a given sector. (Adopted from IEA and IRENA 2019 [2])

After falling down 30% from 2014 to 2016, a slight reflection in upstream oil and gas expenses for the recent 2 years was lower than the increase in oil prices. Spending more on shale and having faster time to market for conventional projects, the energy sector industry is now recovering and able to react to market dynamic processes. Regulating investment to 2018 cost levels shows a rising tendency in spending activity for renewable power sector, about +55% since 2010. For oil and gas, cost reductions have fallen down the impact of reducing investment since 2014.

Prices for goods, e.g. LEDs as well as electric vehicles, have continued to go down. Concerning energy efficient investment, it is cost-effective with comparatively short payback periods. Policy, market, together with financing-related challenges have acted as barriers to increased spending on efficiency.

Modifications are not obvious in all areas, with not big recent progress in improving costs or project cycles for nuclear; carbon capture, utilization, and storage; building retrofits; and some large-scale grid projects.

**Decision-maker goes for investment of “merchant” projects depending on opportunities for risk management besides supportive policy frameworks and market design as well.**

*Table 1.*

**Select renewable power projects with business models reportedly based on “merchant” or “unsubsidized” pricing**

| **Project** | **Market** | **Business model and financial risk management features** | **Policy and regulations** |
|---|---|---|---|
| Talasol Solar PV, 300MW | Spain | Wholesale market sales with 10th year financial PPA with undisclosed counterparty | Partially financed by EU Fund for Strategic Investments |
| York Solar PV, 35MW | UK | Wholesale market sales; hybridization with 27 MW battery storage | Ability to sell grid and ancillary services to transmission system operator |

Looking through such analytical analysis Ukraine can attract investment in renewables cause of solar energy map of Ukraine allow get year around solar energy. While low capital costs solar energy projects for hybrid systems or integrated system development can bring desired profit which can move forward energy sector to clean energy.

**Next step to go – to consider energy efficiency as a resource with Ukrainian legislative base.**

We are defining efficiency as an energy resource which can of yielding energy and demand savings that can relocate investment from coal, natural gas and oil energy sectors. Investing in energy efficiency it is possible to get resulting resource benefits are factored directly into utility energy resource decision making about investing in new resources and operating existing systems. Defining efficiency as a resource and integrating it into utility decision making is especially critical because of the clear resource cost advantage of energy efficiency. Energy Efficiency Projects can work for reducing the requirement to install, upgrade or replace transmission and distribution equipment as well.

When improving Energy Efficiency, we can improve system reliability as well and allow utilities to reduce or manage the demand on their systems — in some cases offsetting the need to add new peak generation capacity.

Reducing fossil fuel use industry has many additional benefits including reducing air pollution improving business image, greenhouse gases reducing. Environmental impacts associated with fossil fuel production and use can be decreased. Where appropriate, decision-makers can consider these benefits as well when making utility system resource decisions.

**Energy Efficiency Resource Standard. Evaluation, Measurement and Verification for Ukraine.**

According ACEEE research, Energy Efficiency is the least expensive, fastest applicable, and cleanest from the each fossil fuel resource. But providing evidence of real and reliable savings is essential to assure funding and public support for energy efficiency programs.

Evaluation, Measurement and Verification validates the value of energy efficiency projects by providing precise, clear and reliable assessments of their methods and performance.

Specialists investigate energy savings also classify causes and effects derived, make recommendations for program goals to create strategic and operational portfolios to meet them and funding levels. For such kind of work, they draw on a lot of sources of various information, both qualitative here we mean focus groups and quantitative when we work with meter readings and demographic surveys.

Common way – to define key objective of evaluation - to determine energy potential, how much savings to attribute to an energy efficiency program as opposed to other factors such as weather. Comparing derived savings to settled baseline levels allows experts to recognize and report the effects of single measures and full programs. Assessing the quantitative effects of Energy Efficiency Programs is called “impact evaluation.”

Along with impact evaluation, experts compare profits and costs for Energy Efficiency Programs. The profits can consist of, but are not restricted to:

- lower greenhouse gas emissions;
- improved public health;
- lower energy prices;
- job creation;
- increased income;
- improved national security;
- reduced construction expenses for utilities.

Defining program design and implementation value is added key function of assessment process. Such assessment efforts are critical to considering and improving Energy Efficiency Program Performance. Program design analysis and implementation is termed “process evaluation.”

Concrete attribution for the Energy Efficiency Program savings is crucial to validate and document that particular programs are able to accomplish their goals and do it. Follow global tendencies and best practices Ukraine can make a big step forward performing measured, evaluated and vivificated Energy Efficiency Projects

We make recommendations to put attention on commercial and financial options to manage market risks for utility-scale renewables.

Physical Power Purchase Agreement [3] – a two-sided commercial contract. A counterparty, commonly utility, purchases at a set price and takes physical delivery of power from a generator. Such kind of agreements are common in both market structures, competitive as well as regulated one however the terms along with rules can differ significantly with the duration of contracts for solar PV and wind plants typically ranging from 10-25 years.

Financial Power Purchase Agreement – can be corporate, synthetic or virtual power purchase agreement and contract-for-differences– a two-sided financial contract where a counterparty agrees to a fixed purchase price, without physical delivery. Generators sell into wholesale markets and the difference between the reference market price and agreed fixed price is reconciled between parties. Financial PPAs are used in the United States, Europe and other power systems where third-parties transact and are often coupled with the sale of renewable certificates or guarantees of origin.

Financial hedge [4] – a two-sided financial contract where a counterparty here is often a bank, which provides fixed payments in exchange for a variable power price based on a predetermined settlement point. Bank hedges of up to 12-13 years can be used.

Proxy revenue swap [5] – a two-sided financial contract where a counterparty, insurance company, provides a hedge against flexible project profits from inexact production volume, timing of generation and electricity prices. 5-10 year swaps can be used.

Forward contracts – standardized financial contracts for electricity traded on market exchanges for settlement at a future date, involving fewer transaction costs than bilateral options. Where available, electricity forward contracts are traded liquidly usually only 1-2 years ahead, but other commodities, e.g. gas, have liquidity further into the future.

**Conclusions.**

Using provided meters, it is possible to conceptualize and develop benchmark tests for energy policy design portfolio. Portfolio balance refers to the relative highlighting of specific technologies. Portfolio consistency refers to the relative emphasis on related innovation system processes. Portfolio alignment refers to the relative emphasis on innovation system processes for delivering targeted outcomes. Deployment of the benchmark tests in Ukraine using data for the Global Strategic Energy Technology Plan which cover five technology fields. It can be defined the Strategic Energy Technology Plan portfolio performs well mostly in areas over which portfolio managers have direct influence such as Research, Design and Development funding. It is shown how the development of effective Energy Efficiency Projects related with Energy Policy can be investigated using measurements of various system processes.

**Literature.**


1. International Energy Agency, [On-line resource] accessed by URL: https://www.iea.org September 2019
2. Renewable Capacity Statistics. International Renewable Energy Agency. [On-line resource] accessed by URL: https://www.iea.orghttps://www.irena.org/publications/2019/Mar/Renewable-Capacity-Statistics-2019 March 2019
3. Power Purchase Agreement Checklist for State and Local Governments. Energy Analysis. [On-line resource] accessed by URL: https://www.nrel.gov/docs/fy10osti/46668.pdf 2019
4. Jon Danielsson. Financial Risk Forecasting. [On-line resource] accessed by URL: https://www.financialriskforecasting.com/files/Danielsson-Financial-Risk-Forecasting-Slides-10.pdf 2019
5. Jay Bartlett. Reducing Risk in Merchant Wind and Solar Projects through Financial Hedges. [On-line resource] accessed by URL: https://media.rff.org/documents/WP_19-06_Bartlett.pdf February 2019

# ЗМІСТ

## ІННОВАЦІЙНІ РІШЕННЯ ПРОБЛЕМ ЕНЕРГОЗАБЕЗПЕЧЕННЯ



## ІННОВАЦІЙНІ ЕНЕРГОТЕХНОЛОГІЇ ХІМІЧНИХ І ФАРМАЦЕВТИЧНИХ ВИРОБНИЦТВ