



טכניון – מכון טכנולוגי לישראל

דני צ'ימנסקי

קצב הפקה אופטימאלי של גז טבעי בישראל



לב הסוגיה....

האם לשווק את מלוא המשאב מהר?

או

האם לשמר את המשאב לדורות העתיד?

“The Earth and the fullness of it belongs to every generation, and the preceding one can have no right to blind it up from posterity”

(Adam Smith, 1766 Lecture on Jurisprudence).



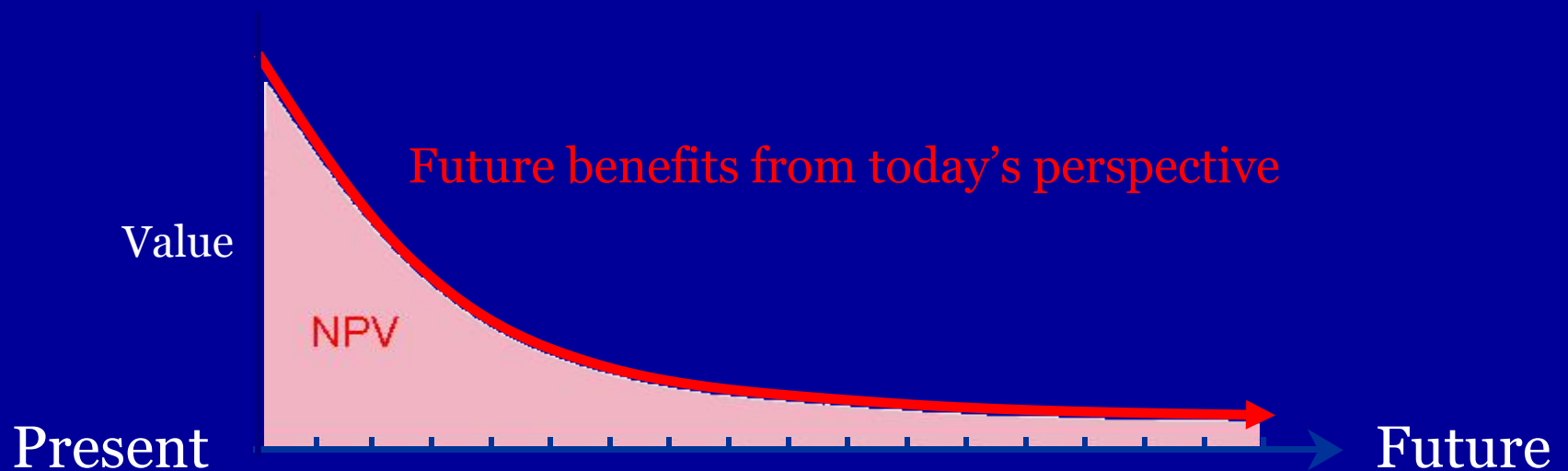
הבסיס למתן מענה לסוגיה....

ערך המשאב בתסריטים שונים.

ערך המשאב היום (לנו) לעומת ערך המשאב לדורות העתיד.

# The 'frontloading' problem

“Egoism is the law of perspectives as it applies to feelings according to which what is *closest* to us appears to be *large* and *weighty*, while size and weight *decrease* with our *distance* from things” (Nietzsche, 1844-1900).





# מרכיב מרכזי של התסריטים - מחירי גז טבעי בעתיד

❖ היווצרות שוק גז עולמי במקום שווקים אזוריים,

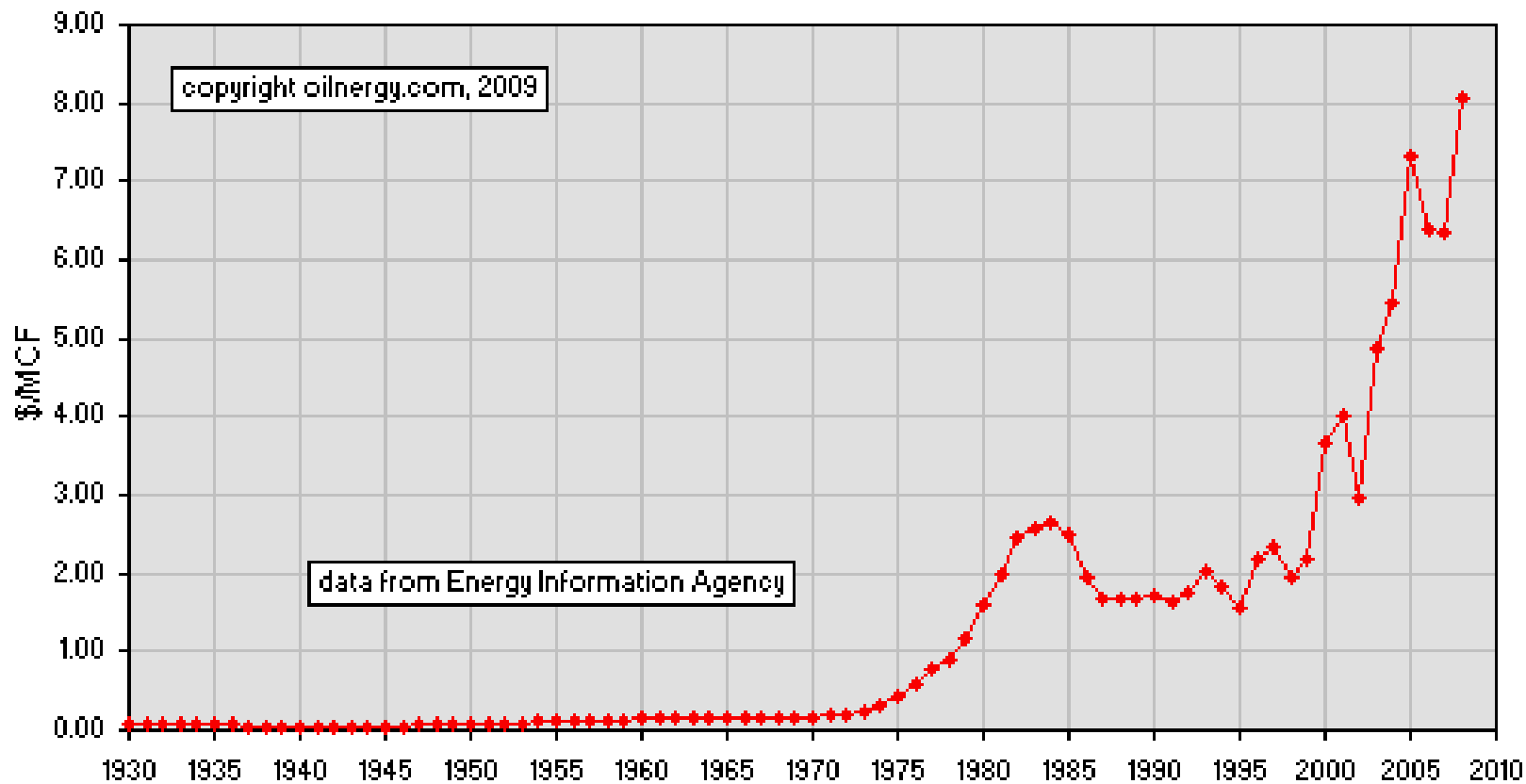
❖ קישוריות השוק הישראלי לשווקים בחו"ל,

❖ היצע גז טבעי בעולם – Gas hydrates.

# מרכיב נוסף - שעור ההיוון

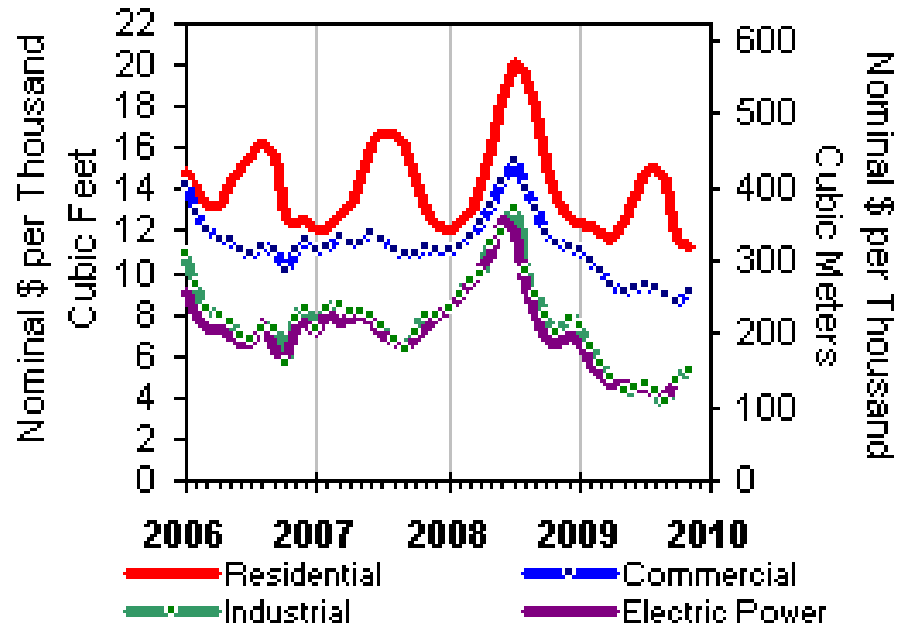


## U. S. Wellhead Natural Gas Price





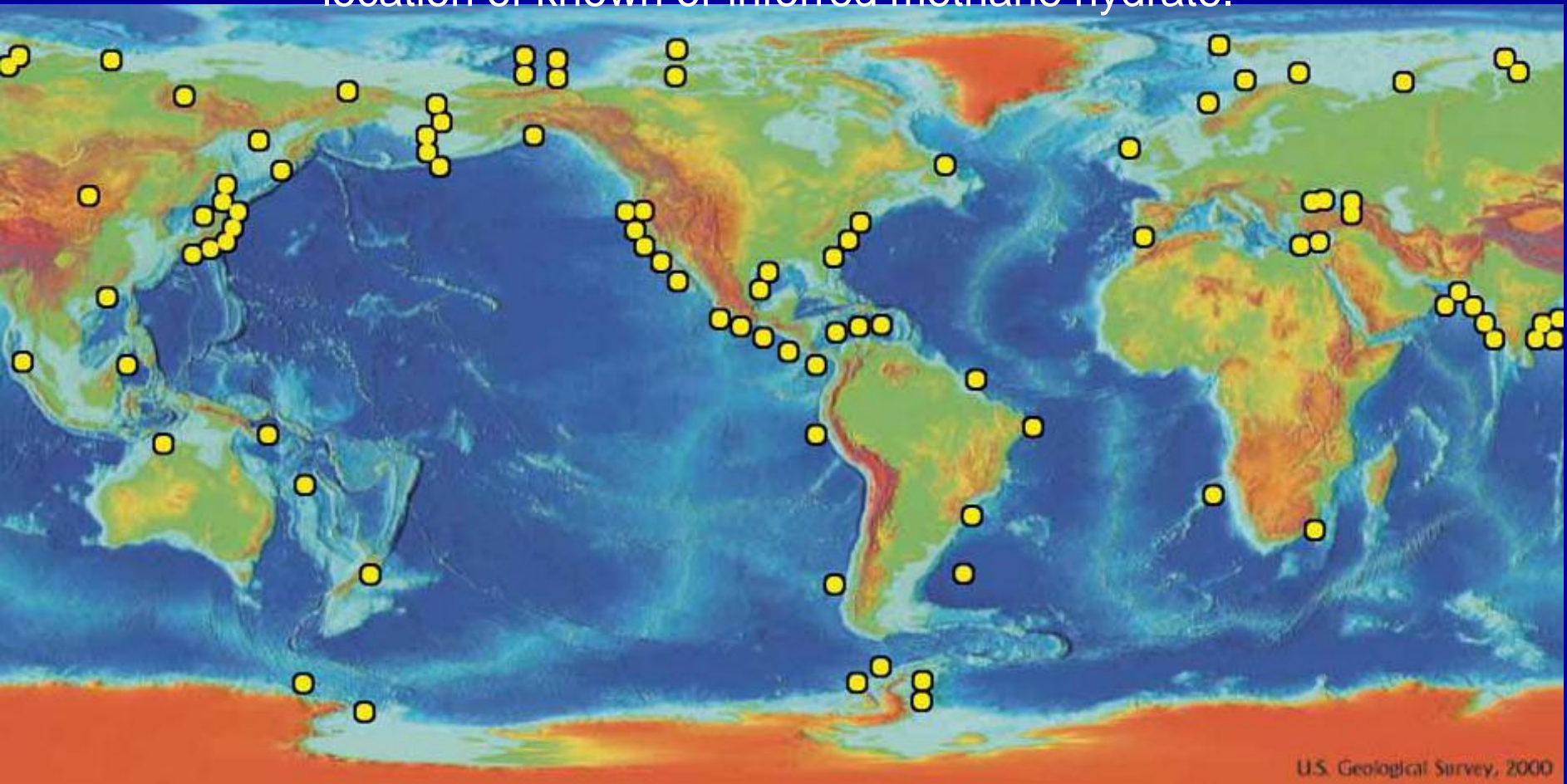
### Average Consumer Price of Natural Gas in the U.S., 2006-2009



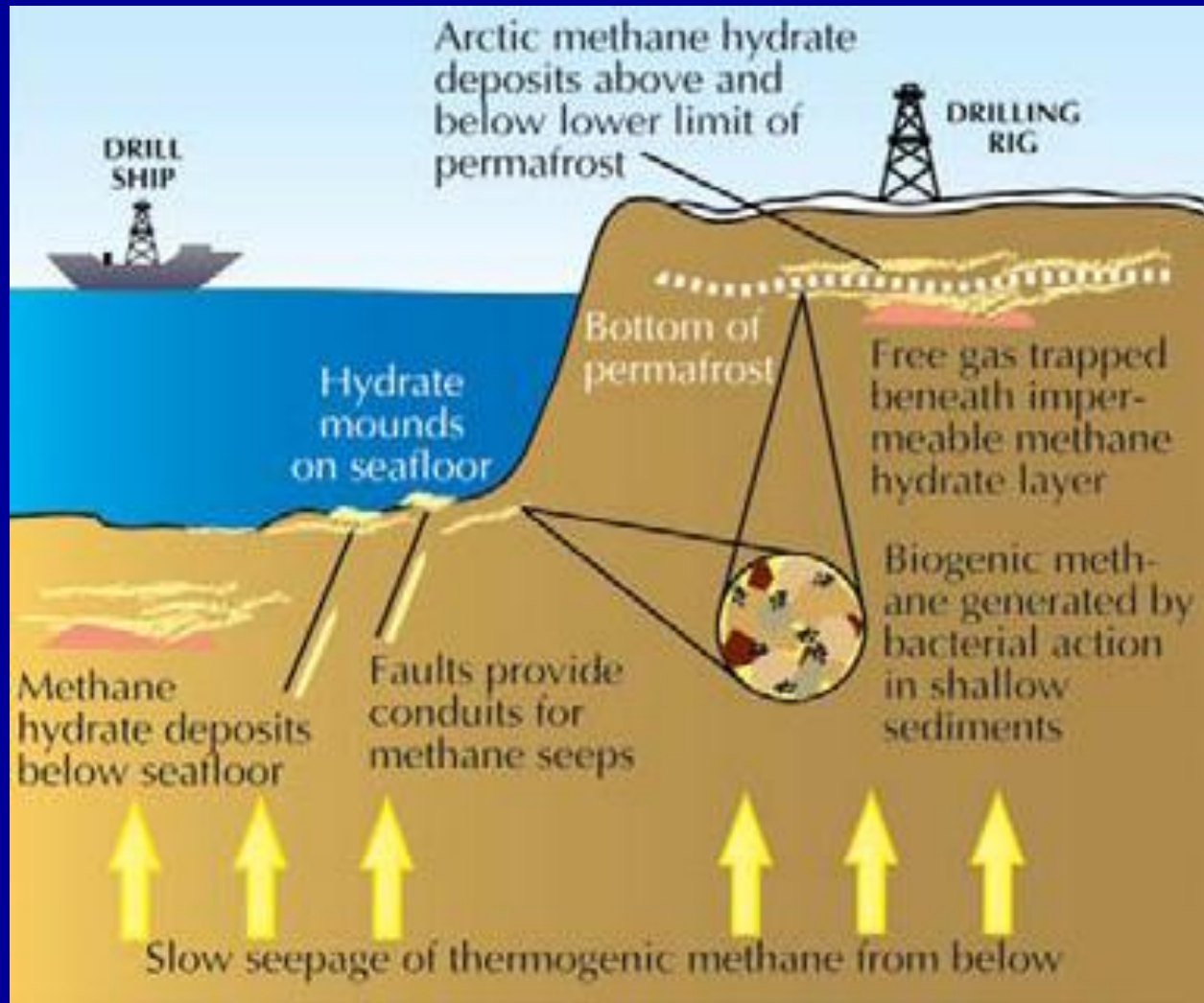


Methane hydrate - molecules of natural gas trapped in ice crystals - represents a resource that may have **as much energy as all the world's other fossil fuels combined.**

location of known or inferred methane hydrate.









## The 'Hotelling Rule':

The market will extract a non-renewable resource so that the price rises at rate of interest.

$$\frac{\dot{p}}{p} = \rho$$

Intuition: if not, then the price will rise either faster or slower than the rate of interest. If slower, then it is better to increase extraction and invest in financial instruments that will by definition grow at the rate of interest. If faster, then it is better to decrease extraction, since the price of the resource in the ground is growing faster than the value of financial instruments. So, the equilibrium rate of extraction will keep the price rising at the rate of interest.



Return from the mine =

present value of marginal profit = price less extraction costs.

- Profits are maximized when the return from the mine is equal across periods.
- Equality of marginal profits across periods requires that marginal profit increase at a rate exactly equal to the market rate of return (the interest rate).
- This means that to maximize profits, the resource owner will extract an amount each period such that the marginal profit from the mine increases at a rate equal to the rate of interest.



## שעור ההיוון

Frank Ramsey (Philosopher/economist)

... it is immoral for people today to make decisions that discount the welfare of future generations.

It is fine to discount one's own future, but not that of another person for whom you are making decisions.

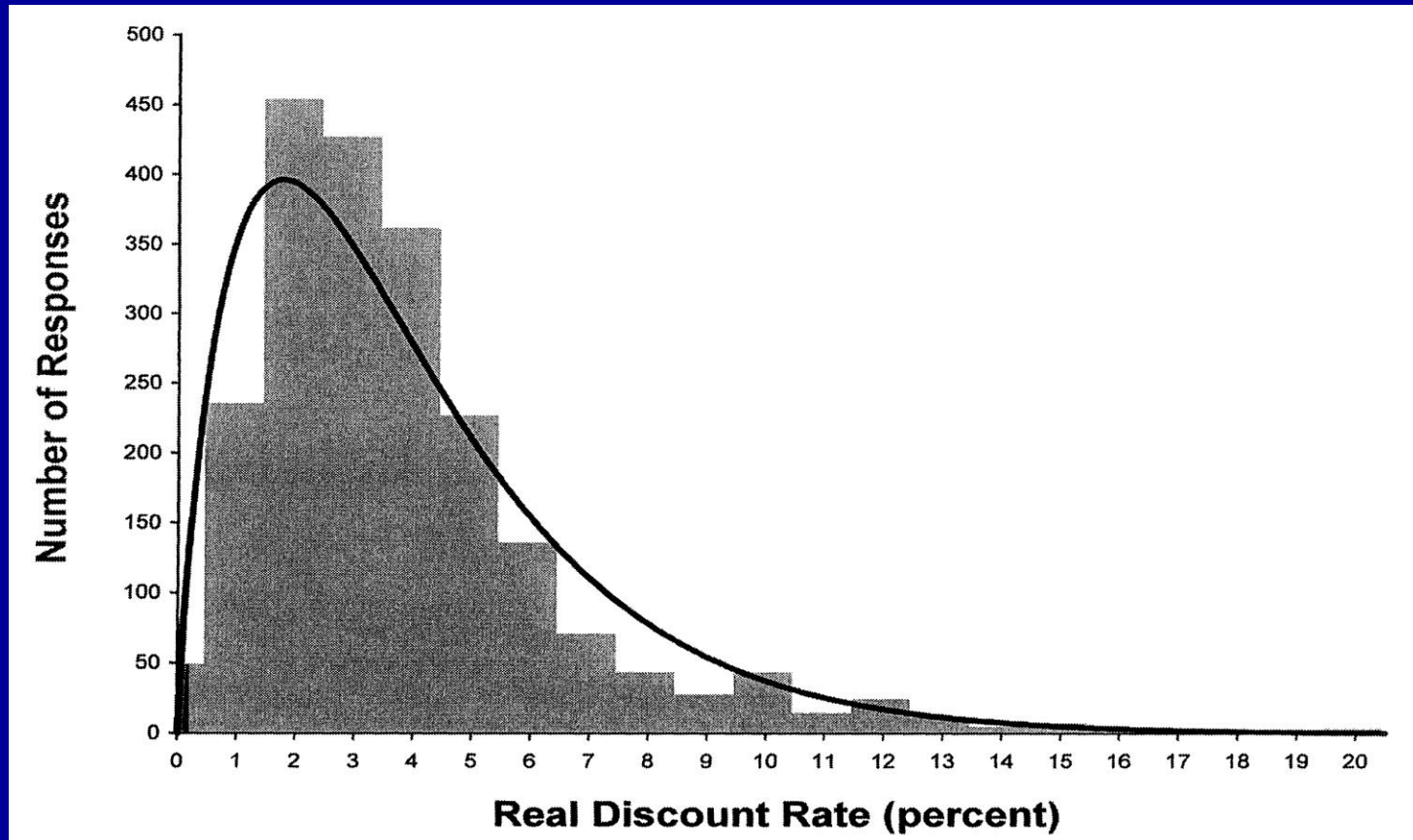


Recent economic theory shows that a *declining discount rate* should be used for long-term resource evaluation.

Based on the opinion of 2000 PhD economists Martin Weitzman suggests that the discount rate should follow the gamma distribution.



# Problems with exponential discounting: Lack of consensus on choosing an appropriate discount rate



Weitzman, M. L. (2001). Gamma discounting. *American Economic Review* 91, 260-271.



ההשערה שלי ....

הצפי הינו להצפה בעתיד ואי לכך יש להשתמש בגז מהר

מאידך

כדאי להשתמש בגז של אחרים היום ולשמור את הגז שלנו  
כמשאב אסטרטגי.

יש להקים ועדת מומחים לבחינת הנושא.