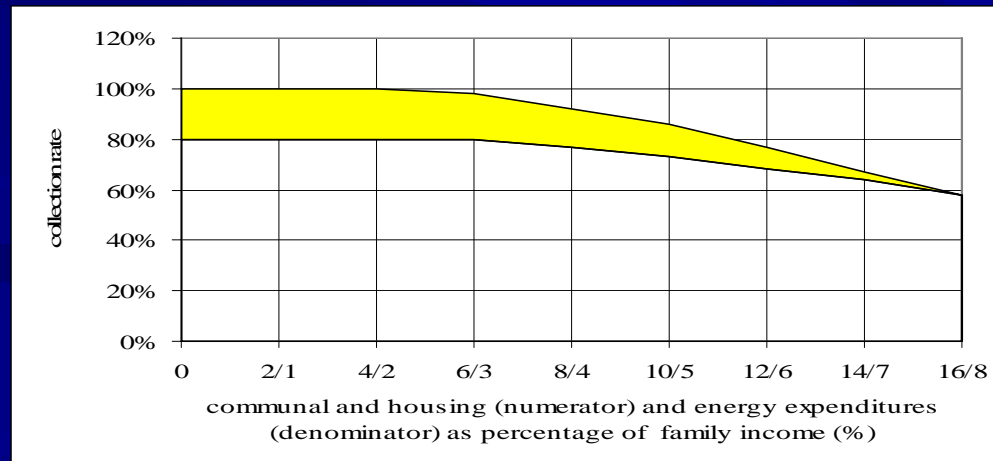




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Affordability of Utility Services in Urban Housing: Energy and Water Efficiency Solutions



The affordability concepts have not been well explored

But knowledge of utility consumers' behavior is crucial for:

- Appropriate integrating of public utilities into the housing and power reforms and country energy policy
- Setting a wise pricing policy
- Developing effective public-private partnerships in the utility sector
 - private capital is reluctant to go to municipalities with low collection rates,
 - financial institutions are reluctant to lend money for communal systems upgrade projects, if the expected collection rates are low
- Designing effective welfare programs
- Understanding the prospects of district heat supply systems revival
- Housing construction development prospects
 - there is a negative relationship between the average share of housing and communal costs in the personal income and the share of income devoted to housing purchase
- Poverty alleviation and mitigating social political tensions, not just in transition economies, but, as recently illustrated by France, in any country

Senior citizens in Siberia protesting against H&C tariffs growth



The share of income spent on housing and communal services

- Is a better and simpler-to-use indicator of consumer behavior, than income and price separately
 - no deflators and exchange rates are needed to make comparisons across any time horizon and across countries

Two affordability limits indicators

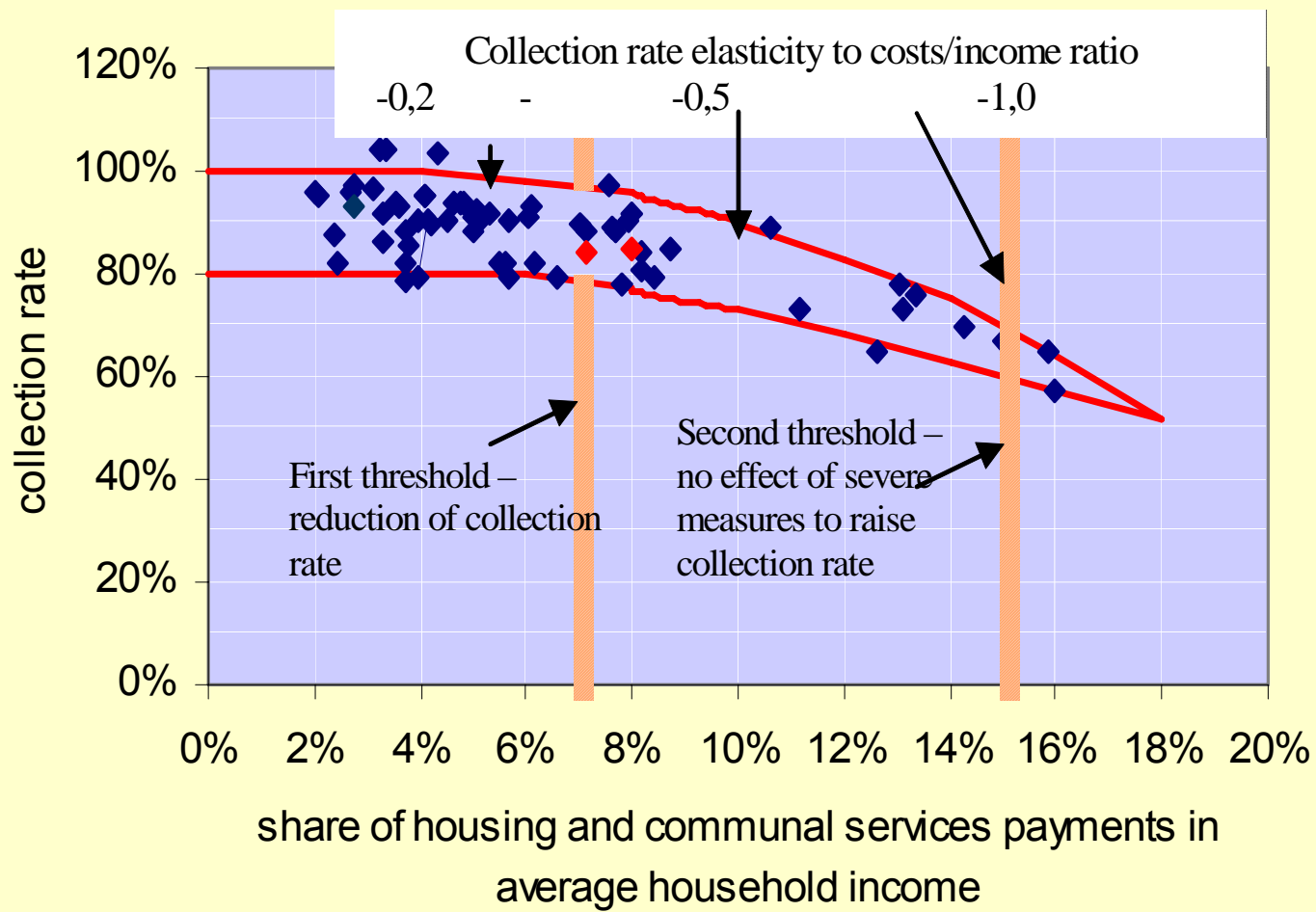
- (i) payment discipline
 - in locations, where the supplier cannot stop supply to those who do not pay; and
- (ii) under consumption
 - In locations where supplier or consumer can not afford to buy sufficient amount of fuel for or pay for upgrade of heating systems to provide sanitary and comfort conditions

There are two affordability thresholds for the H&C costs to income burden

- The first one, for average H&C costs/income ratio, is 7%
 - If this threshold is exceeded, the payment discipline, or adequate energy consumption, declines, and the higher it goes beyond 7%, the lower is the payment discipline, or comfort level services degrades to survival level services
- The second threshold for marginal H&C costs/income ratio is 15%
 - When H&C costs to income ratio reaches 15%, no severe measure to raise the collection rate is effective, and energy services may be only provided at the survival level. This second threshold is a key for designing welfare programs

	The share of H&C costs in the income	The share of communal services costs in the income	The share of energy costs in the income
Average affordability threshold	7%	4-5%	3-4%
Marginal affordability threshold	15%	8-10%	6-8%

The Bashmakov wing



When the second threshold is approached, the demand or payment discipline elasticity to costs/income ratio is below -1 and:

- Supplier faces the upper absolute limit of purchasing power
- Additional price growth does not generate any additional revenues
- Either demand or collection rate declines at best by 1%, or even more, with only indebtedness or revenue losses generated by tariffs growth
- The Bashmakov wing represents an H&C services affordability distribution function among income groups
- It shows decline of demand or willingness-to-pay as share of H&C costs in their incomes escalates
- Households with access to district heating do not sacrifice much of their indoor comfort
- Those with decentralized heat supply switch from comfort to survival level of service
- Low income municipalities are able to provide only survival indoor comfort for the whole municipality

Both thresholds are stable in time and across countries

- The stability of the first threshold is determined by the stability of living/space to income ratio
 - Living space per capita is the best indicator of the wellbeing level
 - In many NIS countries, the income/living space balance was destroyed during the transition period
 - Until it is re-established, low-income part of the society will have to be sacrificing either the payment discipline, or indoor comfort
- Low payment discipline brings down the quality of housing and communal services
- Which in turn has a negative impact on the willingness to pay for these services and locks up the vicious circle
- Going beyond the first threshold leads to the slippery slope to the second one
- The stability of the second - is a derivative of the stability of 20% low income quintile in overall country personal income across all countries

The willingness to pay is below the ability to pay

- Before the first threshold is reached, the width of the “wing” depends on:
 - availability of less expensive (more polluting) substitutes for fuelling heating systems
 - strictness of the payment discipline enforcement
 - the attractiveness of the housing
 - housing company may ask to leave or court may decide take it for debt
 - the quality of services provided, and on
 - the ability to sacrifice the indoor comfort to minimize a welfare loss
- These factors determine the gap between the willingness and the ability to pay

Beyond the second threshold, even the strictest measures taken to enforce the payment discipline have no effect

When the H&C costs/income share reaches or exceeds 15%

- The share of households in debt grows up to 30-40%
- The chances that the debtors are sued and forced to repay the debt are only 10-20%
- When the ratio of house price to annual housing&communal services bill is below 3, housing attractiveness and collection rates are low
- Not only housing and communal services costs/income ratio is important for the payment discipline, but also
- The ratio of market realty price to annual housing and communal bills, which, after all, is a function of incomes in a particular municipality

If the second affordability threshold is exceeded, even welfare assistance cannot fully mitigate the low collection rate or low indoor comfort problem

- Both thresholds are important for effective housing allowances scheme design
- Such design is a research problem with the task to improve collection rates or indoor comfort levels by making services more affordable to low income households
- It should be tuned to a particular country, and even to a particular municipality
- There's no room for effective political decisions, when blind "one size fits all" policy to reproduce schemes from other countries are taken

Demand for better quality energy services means, that more clean and easy-to-handle fuels and energy carriers are used in the housing sector

- They are more expensive, when lifecycle costs of energy service systems are estimated
- Long-term stability of average energy costs to income threshold means, that
 - more expensive, better quality energy services have to be accompanied with improved energy efficiency
- So energy efficiency improvement in the housing sector is
 - a centuries-long trend, and even
 - a law of the civilization development
- Energy efficiency improvement allows for:
 - Mitigate demand for more expensive, better quality energy services
 - keeping energy costs within the affordability limits

Low affordability and low payment discipline are serious barriers to energy efficiency improvements

- Low-income households or municipalities can afford only relatively low-quality energy services, and so they are not so energy efficient, as their higher-income counterparts
- For the poor, energy efficiency allows for a better indoor comfort (coming from survival to sanitary level) at the same cost (no direct costs savings)
- Budget limitations of low-income families (municipalities) are more severe, as well as personal payback requirements
- Lending institutions are reluctant to provide loans to communal companies, households or households associations with low incomes and large debts
- Keeping affordability thresholds helps
 - minimize some barriers to energy efficiency in the housing sector
 - improve the quality of energy services
 - bring comfort to the level required by sanitary norms, and
 - reduce the burden of energy costs both for the needy and the budgets, from which housing allowances are paid

Energy costs affordability is mainly an issue for the buildings in place, even older ones, rather than for newly erected buildings

- In new - more energy efficient buildings - energy services are more energy efficient and so more affordable
- But market price for the new housing is prohibitively high even for the middle class
- Existing housing stock embodies large potential for energy efficacy improvements
- Overall efficiency improvements potential to reduce space heating is 45%, and split by
 - 27% potential at the collective space heating systems and amenities (common spaces and systems) and
 - 18% potential in individual space heating systems located in flats.
- For hot water, it comes to 50% and split by 12% and 38% respectively

If only building-level energy efficiency opportunities are employed, much of the potential hidden in separate flats is missed, and visa versa

- From the engineering point of view, the costs reduction potential is large, but
- Large investments and intensive institutional policy are required to capture both its collective and individual components
- Another issue is an informational barrier - poorly informed stays poor
- The welfare assistance to low-income families may be provided as free weatherization packages
 - to improve indoor comfort and
 - to allow for a transition from survival level to more appropriate indoor temperatures
- In poorly heated buildings such packages may bring indoor air temperature up by 3-7°C

Building level metering is a prerequisite for any energy efficiency improvements in a multifamily building

- Improvements require a balanced combination of collective and individual actions
- After such actions are implemented, flat-level metering does not contribute much to the savings, even with escalating prices
- Prices are escalating, when supplier costs are not controlled, and the bulk of costs is divided by reduced consumption
- It keeps the share of energy costs in residential incomes constant, thus providing no motivation for a more rational behavior
- Inspiration of costs reductions throughout the whole energy and water supply chain is much more important, when affordability issue is addressed, than individual resources consumption metering
- Incorporation of flat-level metering into welfare assistance to low-income families may have sense when metering programs are poorly designed or spontaneous, so low-income families may be billed for all leaks, which are not allocated to their neighbors.

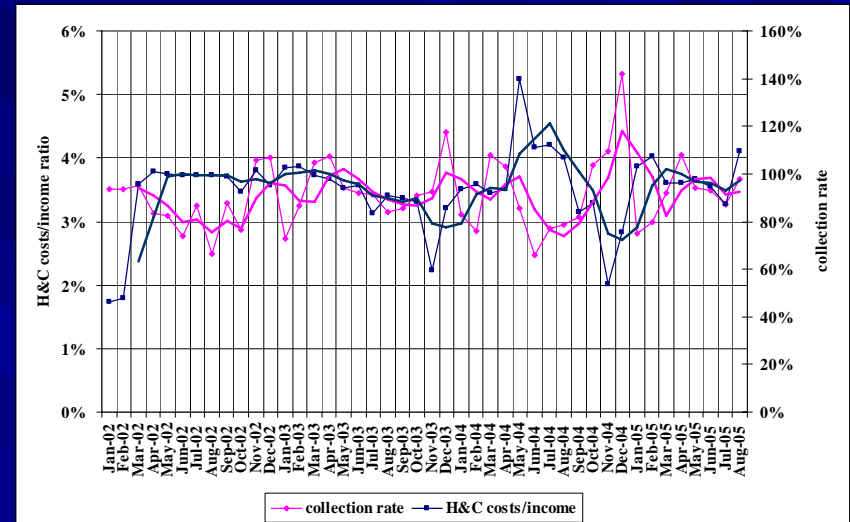
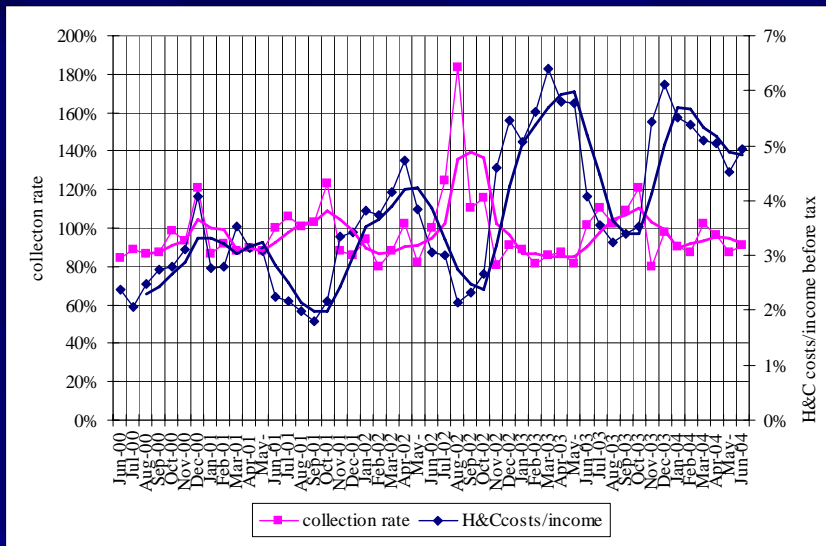
Transition from selling heat as a resource to selling indoor comfort

- What is communal service: resource delivery or comfort provision?
- Today we in Russia mainly are buying comfort
 - only if it is not delivered someone can refuse paying for communal service)
- Comfort may be measured with other devices then flow meters
- Many experts are advising to switch from comfort to resources market
- It is better to stay with the comfort service market with building in it parties motivated for energy efficiency
- ESCOs business is transformation of resource into comfort
- A building-level meter would allow ESCO to benefit from investments made to provide contracted comfort level with lower heat- and water supply
- Residents of apartments can be motivated to improve energy efficiency by a system of payment deductions awarded for implemented energy efficiency improvement measures
 - Flat level flow meters or allocators are expensive, and not necessary effective

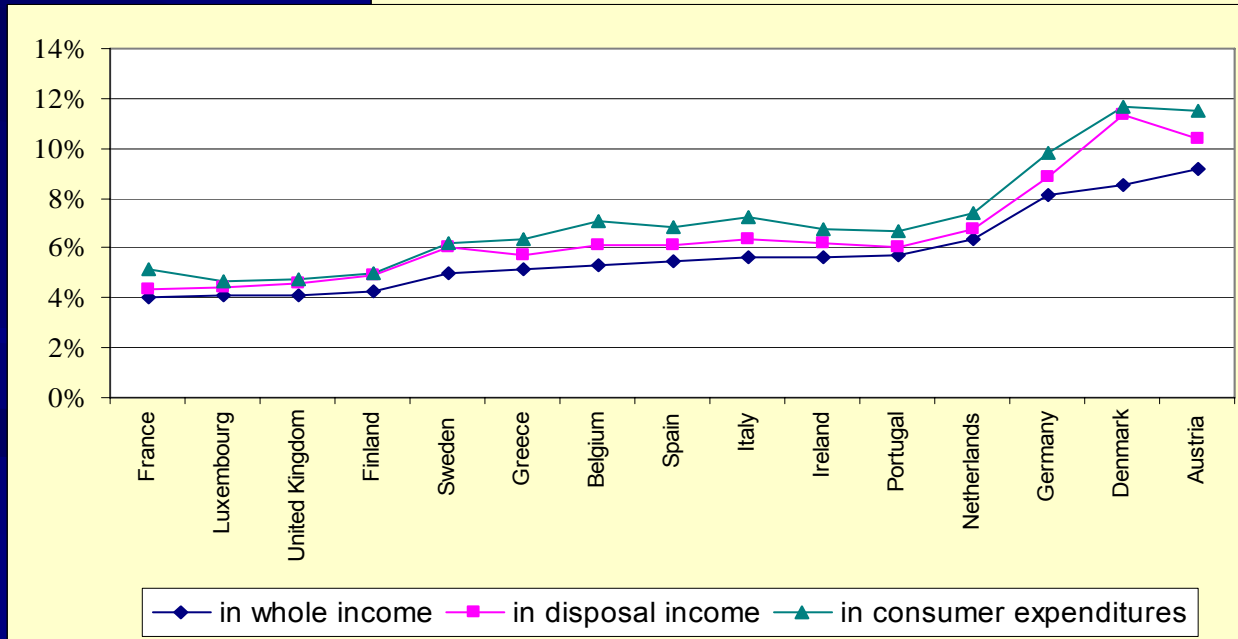
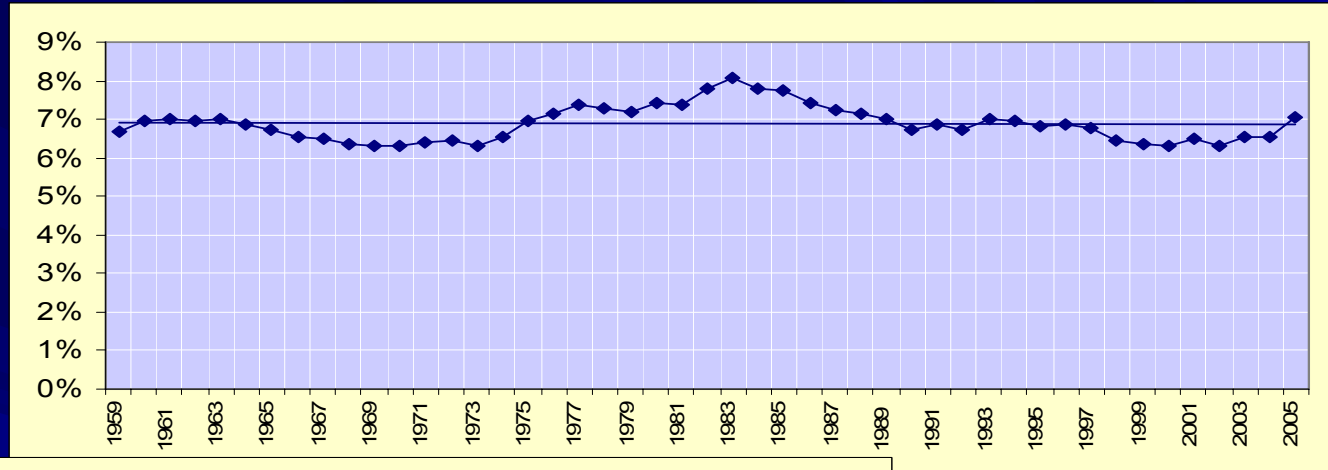
It is a very complex and poorly explored social engineering problem to build the needy into apartment building collective actions to improve energy efficiency

- Associations of housing owners (AHO) were declared to be the only tool to coordinate the interests of private housing owners
- In Russia, for many reasons AHO are developing very slowly
- According to the new Housing Code, only housing owners may participate in selecting housing management companies
- It may scratch low-income families from the selection of service providers and negotiating the price of service
- Service users rather than owners are to select services providers
- Rented car may be fueled where is convenient to driver not to owner
- There are many other institutional settings, which allow for coordinating tenants' energy efficiency activities.
- Including the one - the Association of communal services payers (ACSeP) – proposed by CENEf

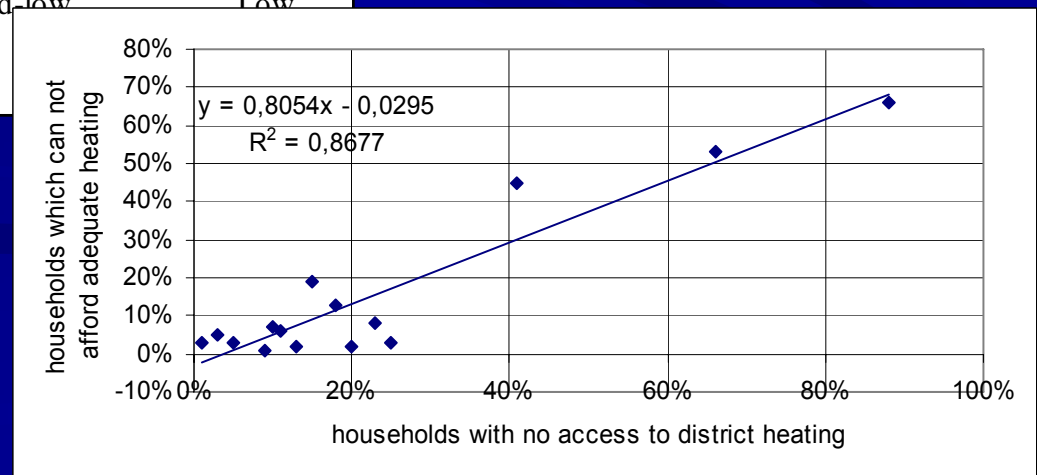
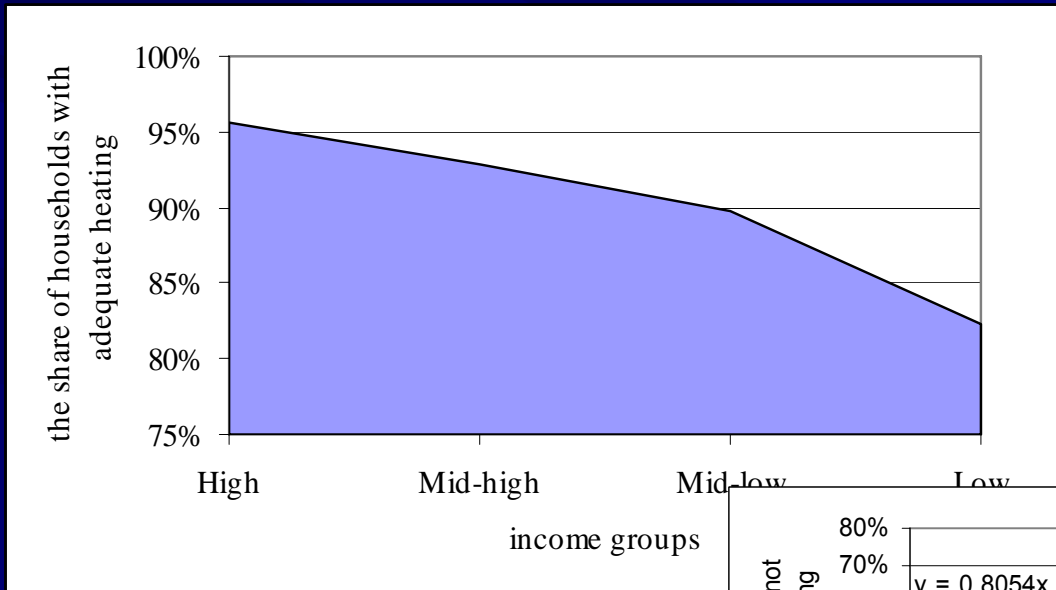
Negative relationship between collection rate and the share of housing and communal costs in personal income before tax (electricity is excluded)



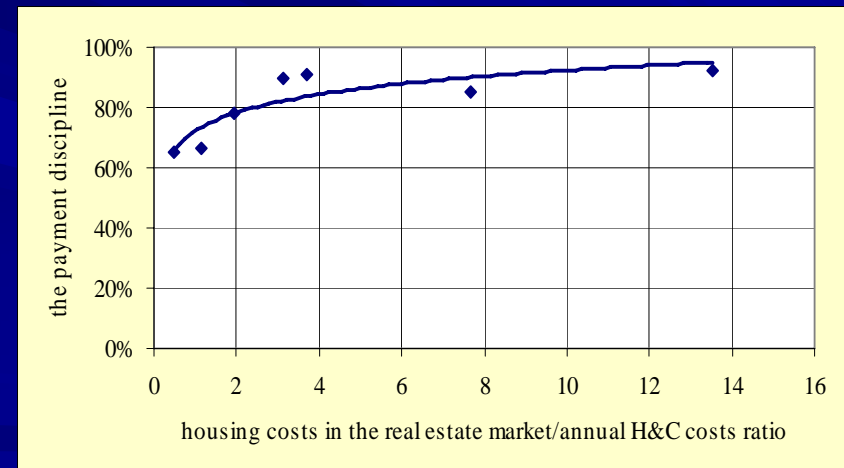
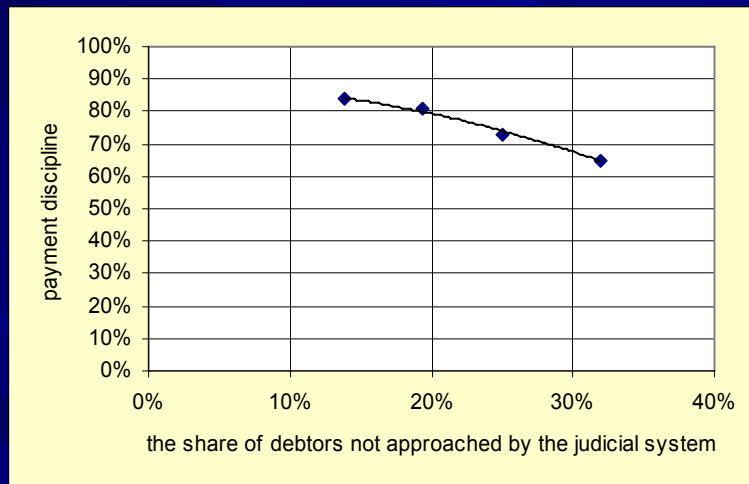
The share of energy costs in personal income before tax in the USA and in EU



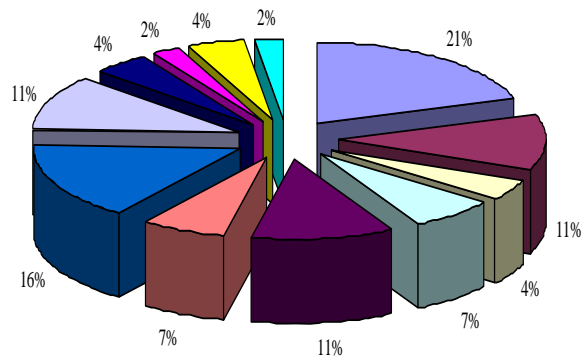
Relationships between income and comfortable heating in EU-15 and between affordability of space heating and access to district heating



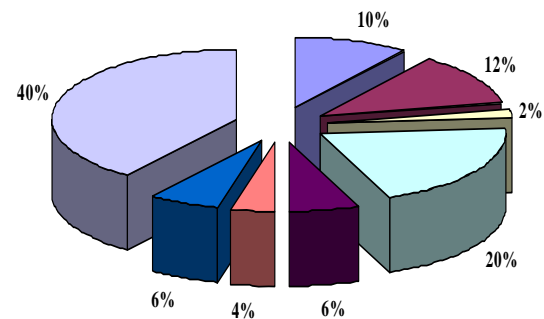
The relationship between payment discipline and the share of debtors not embraced by the judicial system and between the payment discipline and the coefficient of housing attractiveness



The structure of space heating and hot water energy efficiency improvement potential in a multifamily building



- Demand regulation in collective use systems
- Improving insulation of walls (excl. light transparent constructions)
- Same, of basements
- Same, of attics
- Infiltration reduction
- Forced ventilation
- Demand regulation at individual heating devices
- Improving thermal performance of windows
- Same, of balcony doors
- Improving the efficiency of heating devices
- Infiltration reduction
- Use of insulation



- Regulation of heat demand by hot water temperature
- Regulation of hot water demand by end-use pressure
- Insulation of pipelines in the hot water supply system
- Quick regulation taps
- Efficient flushing devices
- Efficient shower heads
- Flat-level meters
- Fostering energy efficiency behavior

Cold water consumption by 75 households in the city of Berezniki equipped with flat-level meters

