



# Water and Wastewater Management in Vietnam: Status, Plans, and Business Opportunities



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  - Status. Challenges. Business opportunities
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# WATER SUPPLY IN URBAN AREAS IN VIETNAM

- **63** provinces. **7** different ecological zones. **94** million population.
- **780** cities and towns: 35.5% of total population.
- Total design capacity of urban water systems: **8.5** million m<sup>3</sup>/day (increased from 1.7 million m<sup>3</sup>/day in 1988).
- Urban population served with centralized water supply systems: **84.5%** (ranging from 57 to 98%) (increased from 40% in 1988).
- Intensive growth over last 20 years
- Investment over last 5 years: USD 550 million (USD 110 million/year)  
(Source: VWSA, 2018)



# URBAN WATER SUPPLY: CURRENT STATUS

- ~ **800** centralized WS systems. **110** urban water supply companies.
- Average water consumption rate: **108 l/cap/day** (ranging from 33 to 213 l/cap/day) (increased from 50 l/cap/day in 1988)
- Non-revenue water: **22.5 %** (8-30%) (decreased from 40% in 1988).
- Operators: Water Supply One Member Co. Ltd, JSC, JSC with foreign share holders, ...

*(Source: VWSA, 2018)*



# NEW APPROACHES AND TRENDS IN WATER SUPPLY

- **Equitization, privatization** is taking place: 100/110 water companies have been equitized.
- Water supply service is being improved; Water quality improvement; Water Safety Plan: **shifting from quantity to quality of service**
- Non-revenue water management;
- **Application of new technologies** in water treatment, distribution, leakage control, asset management, business management, with **application of IT and new management tools** for process optimization & energy savings and lowering operation costs.
- **PPP in water industry**: New Decree No. 15/2015 has been issued to encourage Public – Private Partnership in infrastructure development.
  - BOT, BOO, DBL modes in water projects: Binh An BOT; Thu Duc BOO; Dong Tam BOO; Minh Duc DBL, etc
  - Foreign Share holders: Song Da WTP; Kenh Dong WTP; Song Duong WTP; etc.

# EMERGING CONCERNS AND COMBATING MEASURES

- **Water source:**
  - Climate change, surface water scarcity, salt intrusion, usage conflict, groundwater depletion
- **Water pollution:**
  - Surface water: NOMs, industrial and agro-chemicals, pathogens, chlorine disinfection, ...
  - Ground water: organics, hardness, ammonia, arsenic...
- **Financial Sources and Business efficiency.**
  - Financial sources for water projects
  - Cost recovery.
- **Needs of effective technologies**
  - Removal of ammonium, arsenic, organics from groundwater
  - Membrane filtration for desalinization
  - Energy efficiency in water system
  - Automation, remote control for water safety plan



# HOT ISSUE 1. CO-TREATMENT OF IRON, MANGANESE, AMMONIUM AND ARSENIC IN GROUNDWATER

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✓ Conventional groundwater treatment plants in Vietnam: Production well - Aeration - Contact chamber for iron oxidation (with or without lime and alum addition) - Rapid sand filtration – Chlorine disinfection.

✓ In case of presence of manganese in groundwater, additional aeration, pH rising, application of green sand is often applied.

- Ammonium and arsenic removal?
- Upgrading of existing water treatment plants with cost effective technologies?



Conventional GW treatment plants  
In Vietnam

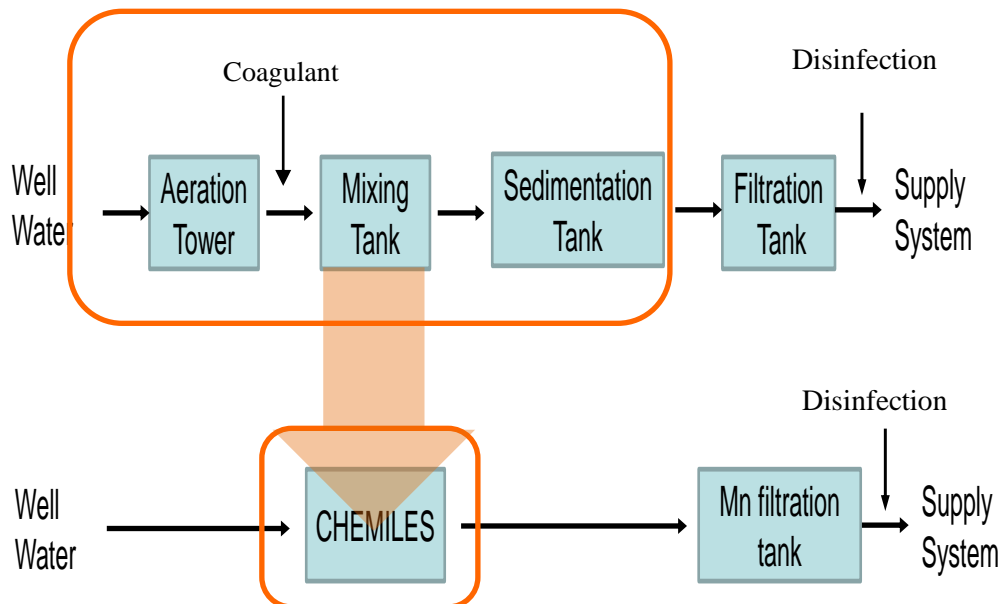
# EXAMPLE OF APPLYING JAPAN'S TECHNOLOGY FOR GROUNDWATER TREATMENT IN VIETNAM

- **Technology Name:**

**Extremely High Speed Chemical-less Groundwater Treatment System – “CHEMILES”** (™)  
(Developed by Nagaoka International Corporation, Japan)

- **Advantages:**
  - High efficiency for Ammonia, Iron, Manganese and Arsenic removal
  - No chemical injection
  - High filtration speed → small footprint
  - Low operation cost, simple management
- **Application place:** Hanoi Water Co. Ltd., Hanoi City, Vietnam (2016)
- **Purpose:** Improving water quality

## Treatment process before and after applying new technology



CHEMILES system  
in Hanoi Water Co. Ltd.



## HOT ISSUE 2: REMOVAL OF ORGANIC MATTERS FROM SURFACE WATER

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- ✓ Coagulation – Flocculation – Sedimentation – Rapid sand filtration is a conventional water treatment technology.
- ✓ Conventional treatment process can remove 30-50% of organics. Powdered activated carbon, Granular activated carbon seem not suitable because of high cost.
- ✓ Inexpensive technology for retrofitting/ upgrading existing treatment plant is needed.
  - Biological carbon filtration (BCF) pre-treatment?
  - Biological carbon filtration with ozonation?
  - Micro-bubble?
  - Other options?



# URBAN WASTEWATER MANAGEMENT

- 90% of HHs have septic tanks
- 4% of septage disposed satisfactorily
- 70-80% of HHs have access to piped drainage/ sewerage systems
- ~17% of collected drainage/ sewerage treated by centralized WWTPs
- 41 municipal WWTPs currently in operation, with total capacity ~950,000 m<sup>3</sup>/day (increased from 2 WWTPs in 2005)
- >30 municipal WWTPs in planning/construction, with total capacity 1.5 million m<sup>3</sup>/day
- Investment over last 5 years: >USD 1 billion (USD 220 million/year) (>80% is ODA, rest is from state budget)

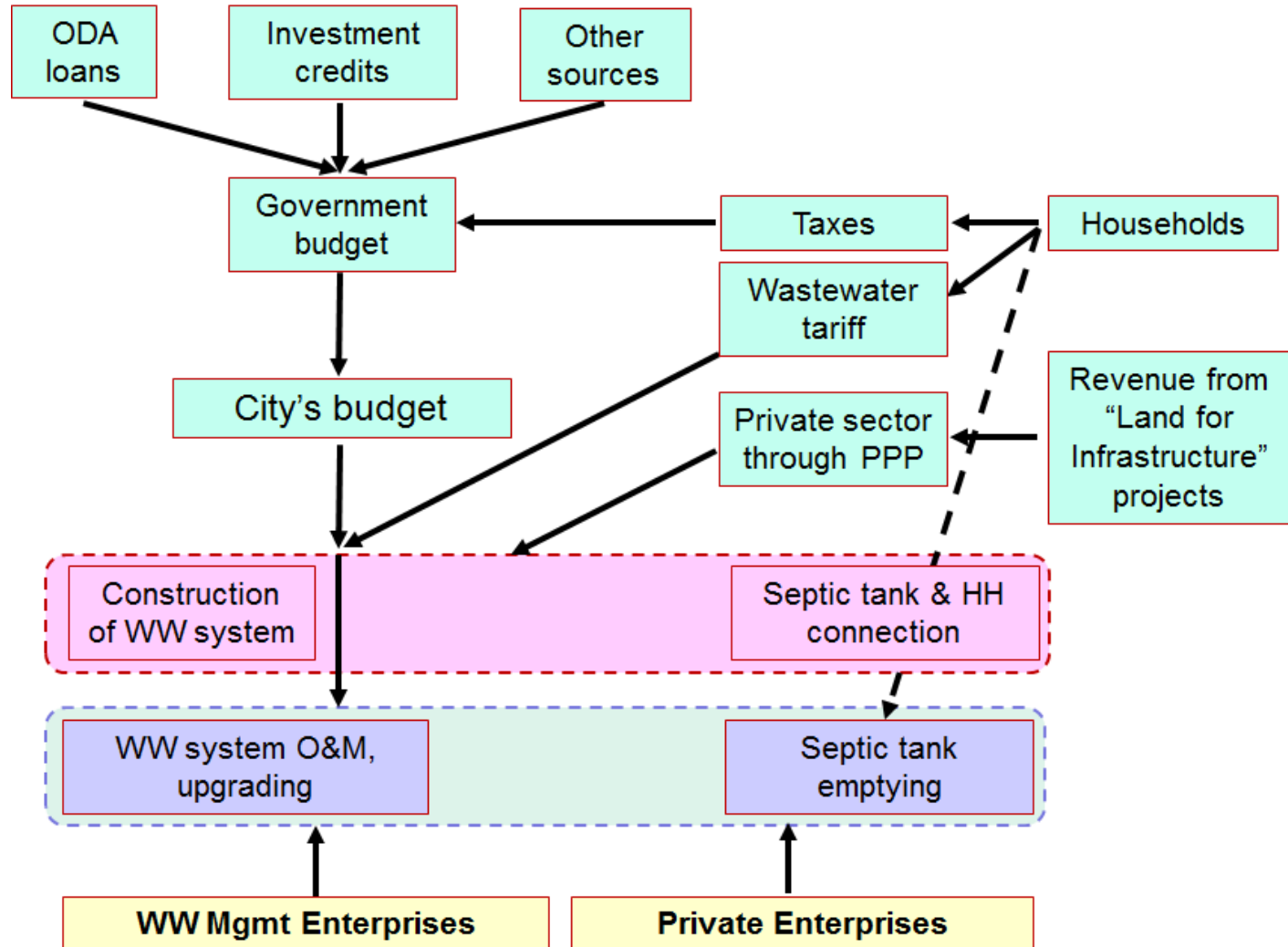


# BARRIERS & CHALLENGES IN URBAN W/W MANAGEMENT

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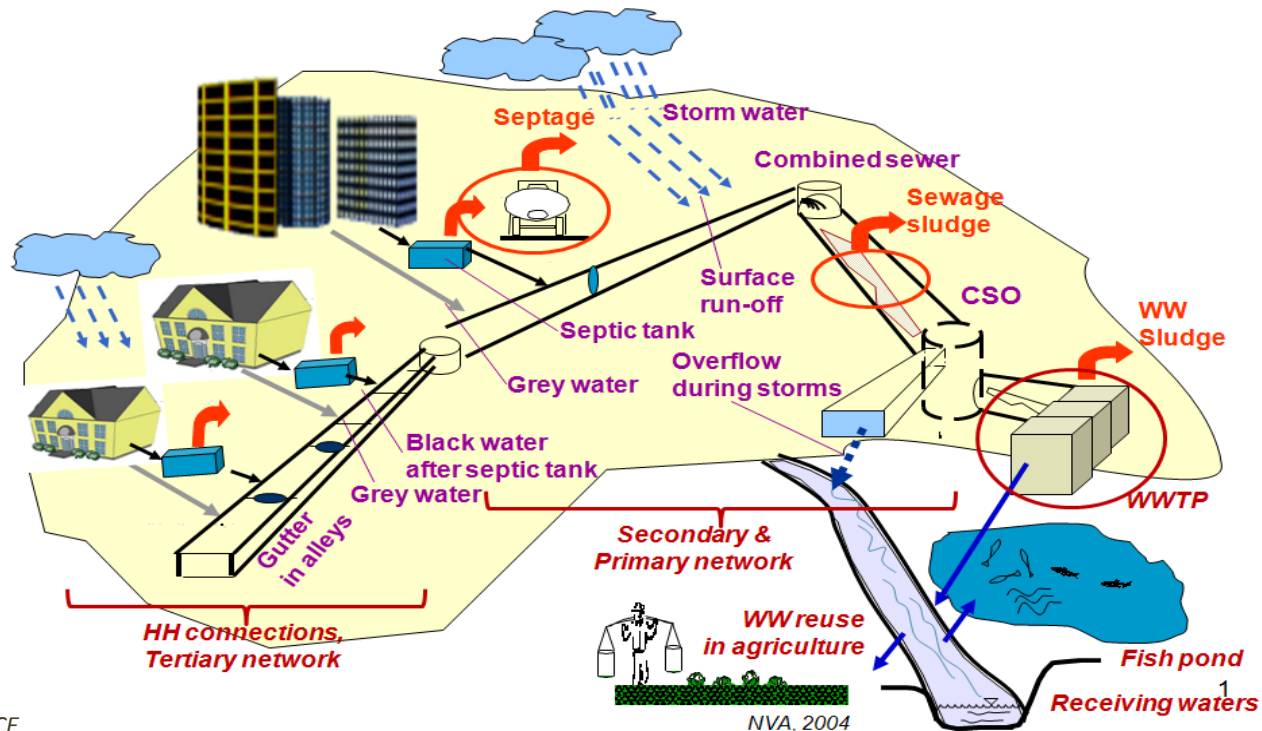
- ✓ CSS (Combined sewerage and drainage system) is dominating in most of existing urban areas in Vietnam. Most of wastewater projects in these areas prefer to stay with CSS, due to limited budget. SSS (Separate sewerage system) is compulsory in new urban development projects.
- ✓ Low C/N in incoming flow to WWTP from CSS is a challenge for biological wastewater treatment processes.
- ✓ Sludge drying and dumping at landfill is a most common sludge treatment method. Utilization of sludge for recovery of energy or valuable materials is to be considered.
- ✓ Fecal sludge management is among hot issues, but not well handled in all cities, so far.
- ✓ Lack of capital investment and low wastewater tariff are among key financial barriers.
- ✓ Private sector started to take part in wastewater management (BT projects, Contract for Operation of WWTPs).
- ✓ It's time to discuss about energy efficiency, and resource recovery in wastewater management.

# FINANCING MECHANISMS FOR WASTEWATER MANAGEMENT



# HOT ISSUE 3: TREATMENT TECHNOLOGY DEALING WITH LOW C/N RATIO IN THE INCOMING WASTEWATER FLOW

- 92% of WW conveyed by Combined Sewerage & Drainage Systems (CSS)
- Challenges: low influent BOD (31 – 135 mg/l: range of annual average flows, vs. 50 mg/l – national class “B” standard for effluent BOD); low C/N ratio for adequate biological treatment processes



# HOT ISSUE 4: TREATMENT OF SLUDGE GENERATED FROM SEWERAGE AND DRAINAGE SYSTEM

- Dredged sludge from sewerage and drainage network
- Sewage sludge from WWTP
  - Dumping is a most common method.
  - Open questions:
    - Composting? Anaerobic (Co-)Digestion? Drying and Incineration? Carbonization? etc.



New project: 75 t Industrial solid waste/day, generating 1.93 MW electricity, Hanoi city (NEDO, Hitachi Zosen)

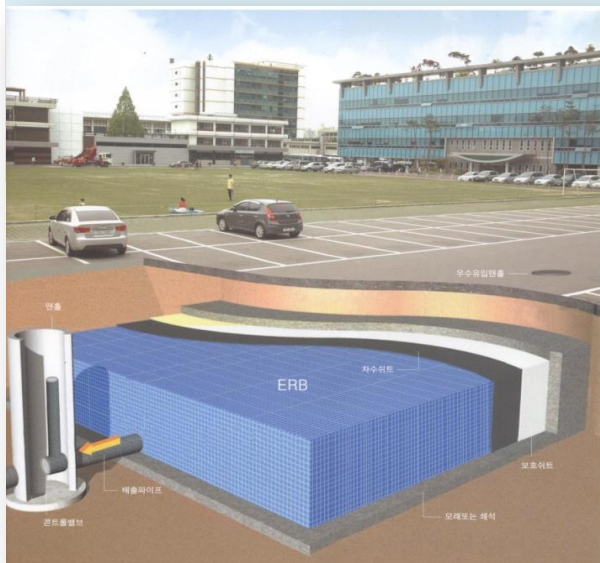
# HOT ISSUE 5: SUSTAINABLE URBAN DRAINAGE AND RAINWATER HARVESTING

- ✓ Many cities are still suffering from floods. Floods are becoming more and more unpredictable due to climate change
- ✓ Comprehensive countermeasures are needed
- ✓ Eco-city and green growth are being encouraged
- ✓ Rainwater harvesting can be realized at household scale, city and basin scale
- Big market for green and smart solutions
- Good models and guidance are needed



## HOT ISSUE 6: GREEN BUILDING, GREEN AND SMART CITY

- **National Strategy on Green Growth** for the period 2020, vision 2030 (2012)
- **National Strategy** on development of **Green Buildings**: drafted.
- **Number of new projects**: in development of smart cities and green cities, Hi-Tech parks, eco-resort areas, ...

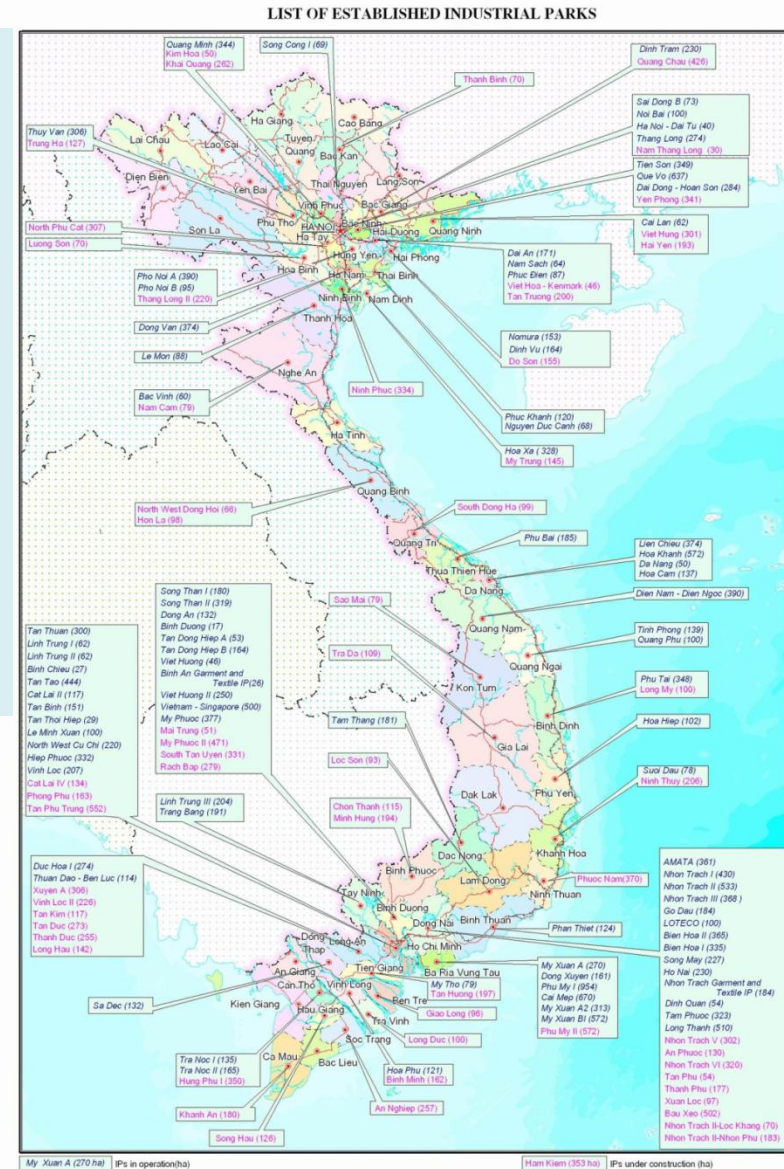




# WATER AND WASTEWATER MANAGEMENT IN INDUSTRIAL AREAS

- Nearly 371 IZs have been established. 280 IZs are in operation, with ~7,500 factories. Average coverage ratio: 70%.
- Centralized WWTPs: at 238 IZs (>86%) (increased from 30% in 2005).
- Some provinces have managed to have 100% coverage of wastewater treatment plants in IZs.

(Source: MPI, 2017, MONRE, 2017)



# CHALLENGES IN INDUSTRIAL WW MANAGEMENT

- Control of incoming flows and O&M of CETPs
- On-site wastewater treatment + Cleaner production at Factories
- Energy efficiency
- Sludge Management
- Financing for Industrial wastewater projects: Investment, Cost recovery
- Pollution control of thousands of Industrial Clusters and Individual Industries; 3,300 handicraft villages.



# COMBATING MEASURES

- Industrial WW management: Polluter-Pay-Principle
- Supporting Policies for Financing, Technologies, Monitoring & Evaluation, etc. (VIPMP project, WB)
- Effluent standard for CETPs and for selected industries: Class A, B
- Installation of AMS; Application of EIA; Post EIA; Discharge License; Inspection Campaigns; Environmental Police; Public Opinions; etc.
- Green IZ development: new concept



# HOT ISSUE 7: INDUSTRIAL WASTEWATER TREATMENT

- Removal of organic substances, color, heavy metals, POPs, etc. from wastewater in specific industries, and in centralized WWTP of Industrial zone, for a reasonable cost
- High efficient wastewater treatment technologies, less foot print, less energy consumption
- Process control and process optimization tools
- Energy auditing, mass balance tools



## HOT ISSUE 8: WASTEWATER REUSE – A NEW INTEREST

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- ✓ Agricultural use: irrigation, fish farming
- ✓ Industrial use: different purposes
- ✓ Treated wastewater use in urban areas
  
- ✓ Reclaimed water is a 5<sup>th</sup> water source (besides surface water, groundwater, rainwater, and saving water)
  - New quality standards should be developed
  - New plumbing code and appropriate equipment are needed
  - Strict control, WSP should be set up
  - Technical guidance are needed

# RURAL WATER SUPPLY AND SANITATION

- **2017:** 95% of rural population are provided with “*hygienic*” water supply.
- ~50% of HHs are provided with “*clean*” water meeting domestic water quality regulation QCVN 02/2009:BYT.
- **Financial sources:**
  - Government budget
  - Favor loans
  - ODA loans and grants
  - Private sector
  - Households
- **Challenges:**
  - Water shortage in remote and coastal areas
  - Water safety (water quality) at HHs
  - Professional management models.
  - Sustainability of rural water supply systems (technical, financial)



# RURAL WATER SUPPLY AND SANITATION

- New management models: PCERWASS, PPP, PSP;... Number of water supply systems have full cost recovery accounting.
- IEC campaigns
- M&E system.
- Results-based projects (PfR - WB, NGOs)
- Centralized water supply system for groups of communes
- Transfer of rural water supply systems to provincial water supply companies



# RURAL WATER SUPPLY AND SANITATION

- **2017:**
  - >80% of HHS are with toilets, among them 60% are “hygienic”.
  - >90% schools, clinics, PC buildings are with WS&S facilities.
  - 50% live-stock breeding are considered as hygienic, including 0.3 mio. biogas digesters.
  - 40% communes are with solid waste collection and disposal.
- **Challenges**
  - Open defecation, unhygienic latrines, especially at poor HHs.
  - Unsafe reuse of feces in farming (30% of rural HHs practice reuse, in which 20% keep fecal materials for more than 6 months)





# RURAL WATER SUPPLY AND SANITATION

- **Measures:**

- Rural Sanitation Planning
- Combination of wastewater collection – treatment – reuse
- Balance among Water Supply and Sanitation financing
- Guidance. Standard design. Manual. Etc.
- Promotion via seeding and demonstration projects
- IEC campaigns
- **New Sanitation Initiatives:**
  - CLTS, Sanitation Marketing, New Low-cost Hygienic Latrines
  - Different sources



# HOT ISSUE 9: WATER SAFETY PLAN FOR RURAL HOUSEHOLDS

- Adequate water treatment technologies in rural areas with polluted water sources (NOMs, POPs, ammonia, etc.)
- Safe drinking water for reasonable costs at household scale
- Rural water supply in emergencies (draught, flood, salt intrusion, land slide, etc.)



# HOT ISSUE 10: LOW COST AND SUSTAINABLE SANITATION SOLUTIONS FOR RURAL COMMUNITIES

- Low-cost hygienic latrine for low-income households
- Low-cost, decentralized wastewater treatment systems
- Low-cost sewerage
- Wastewater treatment for pig farms
- Wastewater treatment for handicraft villages (food processing, furniture, traditional textile and dyeing, etc.)
- Safe reuse of excreta and wastewater in agriculture (soft and hard wares)



# CONCLUSIONS AND RECOMMENDATIONS

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- ✓ Vietnam Water Industry is in the intensive development period: expansion of service area, improvement of service quality, with different stakeholders involved
- ✓ Government policy: PSP is encouraged.
- ✓ Wastewater reuse should be brought up to national policy, along with guidelines, case studies, demonstration and implementation projects.
- ✓ High efficiency, reasonable cost technologies are needed.
- ✓ Cooperation is needed:
  - Sharing information of regulations, problems, needs, solutions
  - Bridging to Vietnam's water industry network and players
  - Investment and joint bidding opportunities
  - Combination of foreign and local consultants, imported equipment and locally fabricated components for reducing costs

# Thank you very much for your attention !

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